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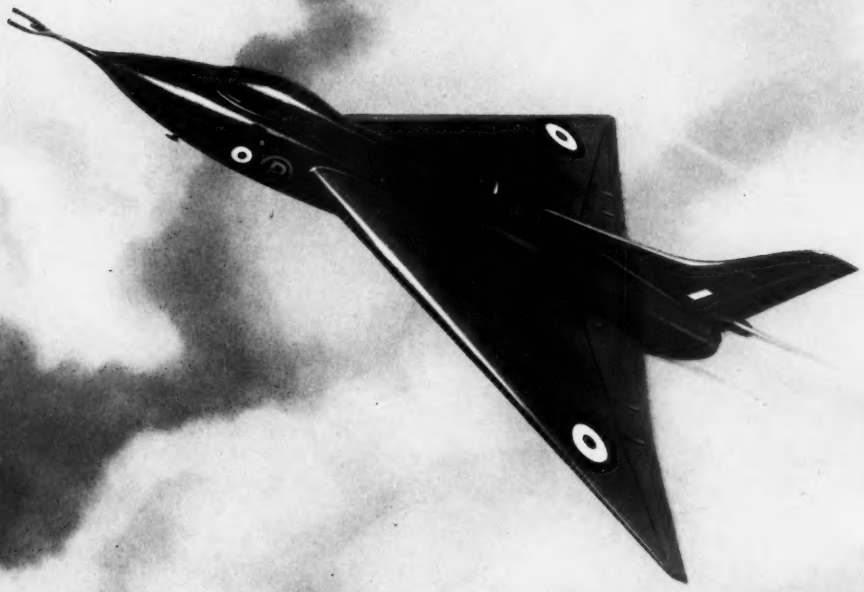

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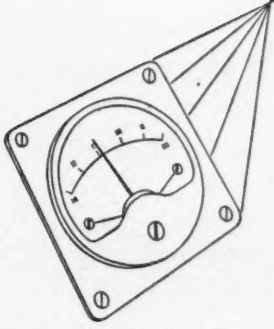

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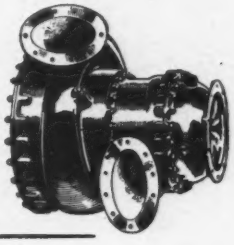

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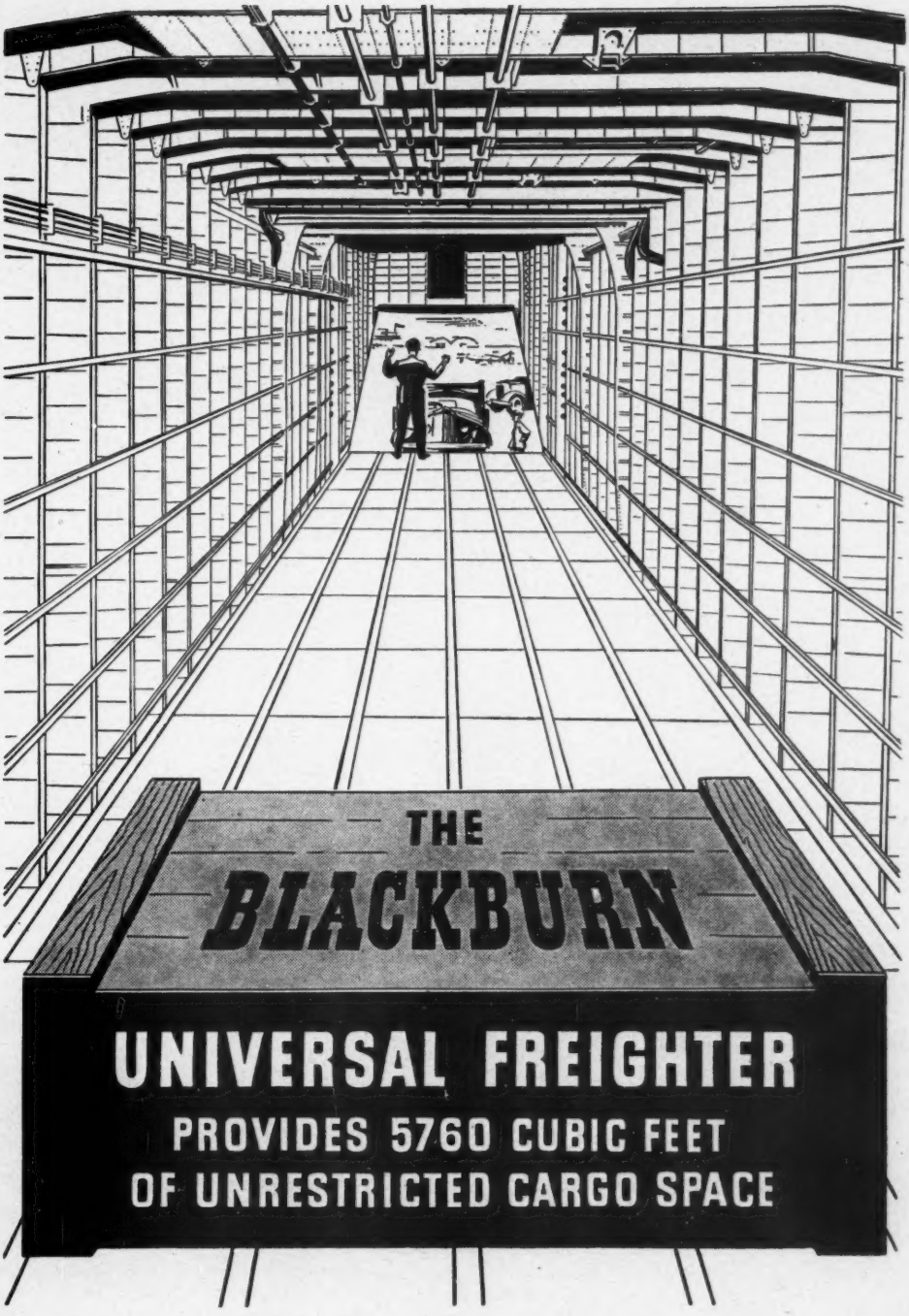
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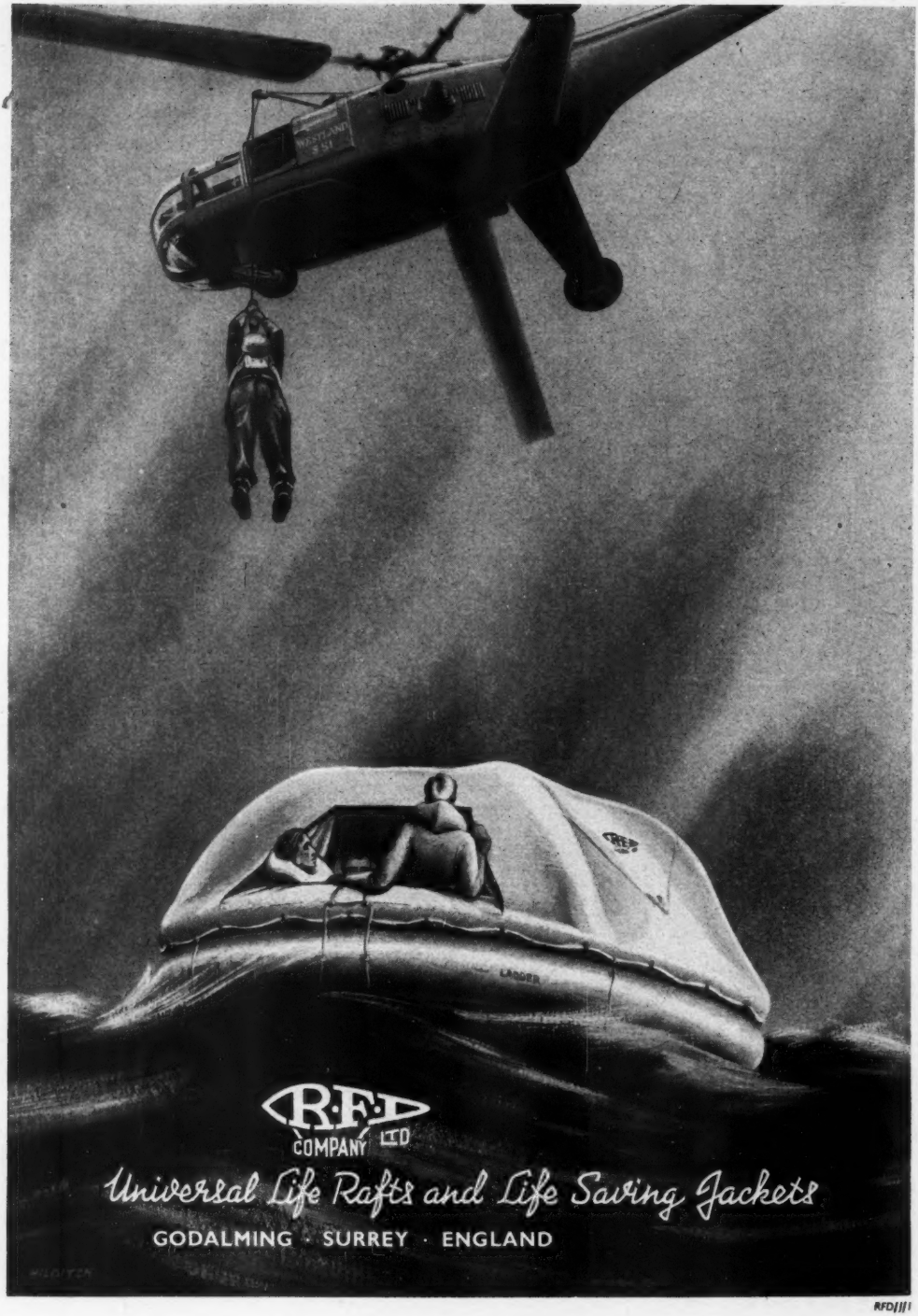
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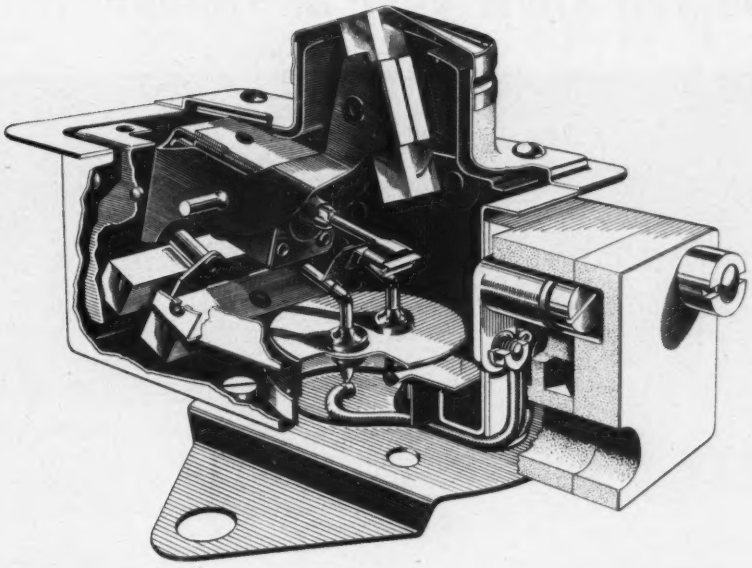

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SIZE	Length	Height from pipe centre	Weight
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2½″ clamp end	5.30″	10.54″	7.09 lbs.
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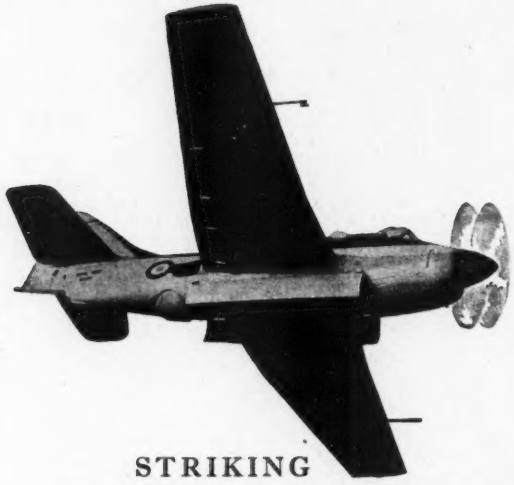

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MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

TECHNICAL EDITOR
C. B. BAILEY-WATSON, B.A.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:
DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

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Telegrams, Autocar, Coventry.
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The Promise of the Delta

ANY man who pronounces himself satisfied with his achievements runs the risk of losing one of the main spurs towards bigger and better things. Progressive aircraft designers, in particular, dare not be satisfied for a moment—unless they are prepared to fade out of the picture. Thus, by the same token, having recorded our gratification and described the encouraging indications of progress made by the Avro company with its 707 delta research aircraft, we feel justified in turning our thoughts at once to the future.

In the first place, several authorities have more or less staked their reputation on the promise offered by the delta-wing configuration. A. V. Roe are already able to demonstrate that a great deal of what was until recently theory can now be accepted in practice. The confidence with which Mr. Roland Falk handles the 707B is most heartening, for it indicates that, despite its still unfamiliar appearance, the delta may now be regarded by pilots as just another aircraft. It also serves, incidentally, to indicate the difference between the delta-wing aircraft, with its low aspect ratio and conventional controls, and the high aspect ratio so-called flying wing, with elevons, spoilers and such like, which to date has earned a not very enviable reputation among pilots in England and America.

Nevertheless, a couple of valuable delta research aircraft cannot in themselves achieve enough. It is, therefore, to be hoped that without delay orders will be placed for several larger aircraft based on the successful prototypes. Of necessity, many months must elapse before such machines could be built; but we hardly need to draw attention to a conclusion in an authoritative article in this issue (pages 172-174)—that it is in the large sizes that the delta is likely to offer the greatest advantages—or that A. V. Roe have the experience and a first-class plant for producing large aircraft, and one which, so far as we know, is not at present being employed to anything like its full capacity. We understand that A.V-M. Boothman, Director of Supplies (Air), has turned his very experienced and practical eye with favour upon the delta. This augurs well for the future.

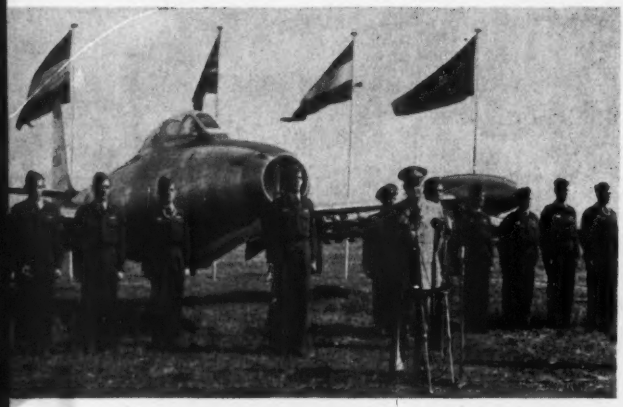
Excellence Apparent

TIME was when the Meteor and Vampire were far and away the world's best fighters. The Meteor excelled in speed, climb and acceleration, while the Vampire led in manœuvrability at height. So well did these complementary types perform that many people who ought to have known better became hypnotized by their excellence and by their remarkable possibilities of development. It was this state of mind which allowed the present situation to develop—with R.A.F. fighters inferior in speed to American and Russian counterparts.

Of course, there was little question that new British fighters would some day restore our former position of all-round superiority, and the demonstrated qualities of the Hawker P.1081, Supermarine 535 and de Havilland Venom prototypes helped to sustain this belief. But the months dragged by and news that American or Canadian Sabres might eventually be diverted to the R.A.F. did little to allay a fear which the Korean war proved to be well founded—that Russia possessed a standard fighter comparable with America's best.

Now, at length, the scene is brightening. Venom production is well advanced and orders have been placed for the Supermarine Swift and Hawker P.1067. The first Swift has yet to fly, but tests of the 1067 are under way, and the Air Minister has said of this beautiful fighter that it was designed not only to deal with any bomber likely to be in service for some time, but to be faster and to have a higher performance than either the Mig-15 or the F-86. Both Sabre and Mig are being further developed, but anyone familiar with the history of British fighter design would think twice before challenging Sir Frank Spriggs' confident belief that the 1067 is "the best fighting aircraft flying anywhere in the world to-day."

We may hope that the time is approaching when we may justly claim, as in the early days of the Spitfire and Hurricane, that our standard fighters are superior, even, to the *prototypes* of potential enemies.



GROWING STRENGTH: On August 1st, during the Internationale Luchtvaart Show at Ypenburg, the first Thunderjet of the 13 due to be given to Holland as a North Atlantic Treaty country was presented to the Dutch Air Force by General Eisenhower. Thirty-seven F-84s for distribution in Western Europe were incidentally, unloaded from the U.S. aircraft carrier "Corregidor" at Glasgow last week-end.

FROM ALL QUARTERS

Canberra To Australia

THE first of the English Electric Canberras for delivery to the Royal Australian Air Force left R.A.F. Station Lyneham early on August 1. A B.Mk 2 equipped with wing-tip tanks, the aircraft was flown by W/C. D. R. Cuming, A.F.C., with F/L. Colin Harvey as navigator. Both are officers of the R.A.A.F.; W/C. Cuming is its chief test pilot.

The aircraft touched-down at Melbourne on Monday last, August 6th, having covered the 12,677 miles in 25 hr 27 min flying time, an average of 490 m.p.h. It was met by Mr. Menzies, the Prime Minister, and Mr. McMahon, the Air Minister.

Speculation in the daily Press has connected the delivery-flight with the rumour that tests of the first British-made atomic bomb are shortly to take place at the Woomera range. In our own view it is more likely that any such initial test would be a "static" one; live dropping tests of any further bombs would follow later.

Short's Technical Director

FROM Short Brothers and Harland, Ltd., comes the announcement that the chairman "has accepted with very real regret" the resignation of the company's technical director, Mr. C. P. T. Lipscomb, Wh.Ex., F.R.Ae.S., who has expressed a desire to be relieved of the highly exacting day-to-day responsibilities attached to his appointment. At the special request of the board, however, he remains a director.

C. P. T. Lipscomb has been connected with aviation from its earliest days. In 1914 he joined the Short brothers at Rochester, and from 1916 to 1921 was chief draughtsman of their airship works at Cardington. During 1921 he held various technical positions with the company and was associated with all the between-war projects for which they became world-renowned; these included the Cockle, the world's first all-metal flying-boat. He was appointed chief designer in 1943 and a director in 1945.

Mr. Lipscomb's technical responsibilities will devolve upon the chief designer, Mr. D. Keith-Lucas, and the chief engineer, Mr. A. W. S. Clarke.

Short Brothers and Harland also announce the appointment of Capt. H. St. John Fancourt, D.S.O., R.N. (Ret), to the post of assistant general manager. Capt. Fancourt has for some time been personal assistant to the managing director, Rear-Admiral Slattery, and in his new position he will be responsbile for a wide field of general organisation and administration.

Capt. Fancourt served in the Royal Navy from 1913 until 1949. He qualified as a pilot in the first course of naval officers for the Fleet Air Arm in 1924, and thereafter he filled a variety of responsible appointments connected with Naval Aviation.

Mr. Lipscomb, whose resignation from the post of Short's technical director is announced on this page.

B.O.A.C.'s First Quarterly Profit

FOR the first time in its history, B.O.A.C. has achieved a profit on operations for a three-month period. The actual figure was £40,000 for the quarter April-June. Total revenue for June was £2,700,000, again the highest on record. Except for the months of January and February a steady profit has been shown on Eastern routes. There is a seasonal profit on the North Atlantic services and the deficit of the South American Division has been notably reduced; there are also signs that revenue will remain high until the end of October.

This considerable improvement in B.O.A.C.'s results suggests that the overall deficit for this year may be much lower than was previously expected.

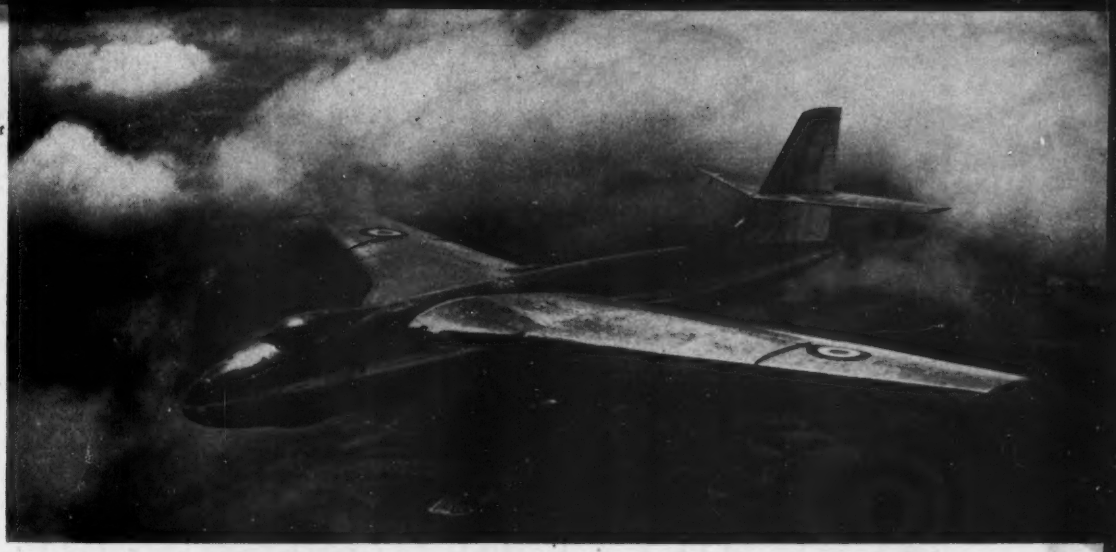
Commons Discuss R.A.F. Equipment

SEVERAL types of aircraft and a variety of topics concerning the equipment of the R.A.F. came under discussion in the House of Commons on August 1st. Pending fuller treatment later, some of the points raised are touched upon here.

A. Cdre. Harvey referred to a mock-up Hastings with rear loading and quoted an American report which mentioned the Supermarine F.1, Swift and Hawker F.3.

Mr. Arthur Henderson stated that jet-propelled aircraft are under consideration as Hastings replacements. It might be that a four-jet bomber could be suitably developed; the Comet might

H.R.H. PRINCESS ELIZABETH inspecting No. 603 (City of Edinburgh) Squadron, of which she is the Honorary Air Commodore, on the occasion of the presentation of the Esher Trophy to this R.Aux.A.F. unit on Saturday last.

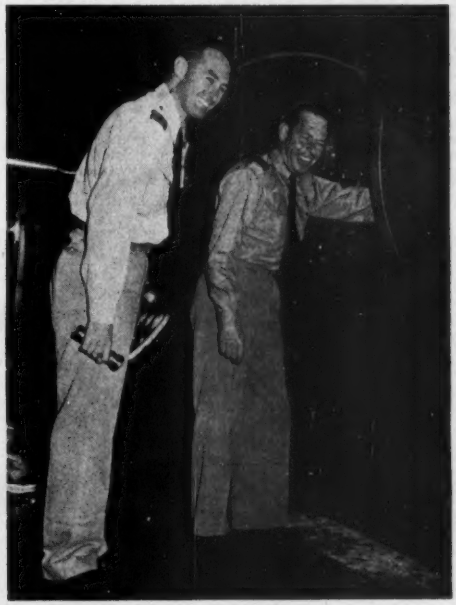


BIANGULATE PLAN-FORM: In none of the photographs of the Vickers Valiant hitherto published has the form of the gently swept-back wing been apparent. Neither has it been possible to see, until now, the individual tailpipes from the buried Avons. These features, together with the small "fences" at the aileron break, and the curious downward-sloping base-line of the rudder, are all additional points of interest in this, one of the most interesting—and elegant—aircraft in the world.

meet the case; or we might have to obtain some American Fairchild C-119 Packets. If F-86 fighters were obtained from America, these would not be substituted for any aircraft ordered in this country. A "respectable number" of Canberra squadrons would be formed during the next twelve months, including a "number of V.R. squadrons" (*sic*—possibly a mis-reporting of "P.R."). The Valiant will be superior to the Canberra in range, speed, altitude and load. Mr. Henderson described the Mig-15 as "probably the second fastest fighter in the world to-day"—second to the F-86. We were not satisfied with the number of Chipmunks available—118 in Reserve Flying Schools, 105 in the University Air Squadrons and 70 in the new schools for National Service trainees. Mr. Henderson used the designations "F.3" and "B.9," apparently in respect of the Hawker P.1067 and Valiant.

Mr. Profumo quoted a report of an excellent performance by the Blackburn and General Aircraft Universal Freighter at a recent demonstration. Here, he believed, was an aircraft which might easily accompany the Canberra into production for the U.S.A.F.

Mr. George Ward wished to know why we had ordered only twenty or so Vickers 660s and referred to new Handley Page and Avro bombers.



W/C. D. R. Cuming, A.F.C. (right) and F/L. C. Harvey, both of the R.A.A.F., look pleased with the prospect of taking the Canberra to Canberra. *(See news item on opposite page).*

F. M. Owner Leaving Bristols

AN announcement from the Bristol Aeroplane Co., Ltd., states that Mr. F. M. Owner, C.B.E., M.Sc., F.R.Ae.S., M.S.A.E., is, by mutual agreement, relinquishing his position as chief engineer of the company's engine division, and in due course will take up another

Dr. S. G. Hooker.

Mr. F. M. Owner.

appointment elsewhere. Dr. S. G. Hooker, O.B.E., A.R.C.Sc., B.Sc., D.I.C., D.Phil., F.R.Ae.S., F.R.S.A., previously deputy chief engineer, becomes chief engineer of the division.

Mr. Owner has worked on engine design with the company since 1922, and has delivered a number of notable papers on power-plant development and requirements.

Before joining Bristols in 1949, Dr. Hooker had been with Rolls-Royce, Ltd., from 1938; he was chief engineer of their Barnoldswick division.

Unlucky Air Racing

ONCE again bad weather has been an unwelcome entrant for a major British air race: last Monday's *Daily Express* contest could not be flown, and has been postponed until September 22nd.

The 1951 Festival of Britain National Air Races—which include the King's Cup—"rained out" at Hatfield on June 23rd and postponed until September 15th, will not now take place.

An account of the Shoreham *debâcle*, and reasons for the abandonment of the National Races, are given on page 175.

Since the 707B appeared at the S.B.A.C. Display last year the dorsal intake for the Rolls-Royce Derwent turbojet has been extensively modified, as seen to advantage in this flying view, secured from a D.H. Rapide.

"Flight" photograph

AVRO DELTA DEMONSTRATED

A Wing Form of the Future: Convincing Indications of its Practicability

SOMETHING of a milestone has been reached by the Avro Company in delta-wing development and, so that it should not pass unnoticed, a way was sought, within the bounds of strict security, to review the success of the work to date and to exhibit the excellent results. A demonstration was therefore arranged at Dunsfold airfield, near Guildford (recently taken over by the Hawker division of the Hawker Siddeley Group) in order that test pilot Roland J. Falk might show off his sleek and angular charge. The technicians principally concerned (Mr. S. D. Davies, B.Eng., F.R.Ae.S., chief designer, and Mr. J. R. Ewans, A.C.G.I., B.Sc., D.I.C., A.F.R.Ae.S., chief aerodynamicist) were also enabled to tell of their convictions and intentions regarding the delta configuration.

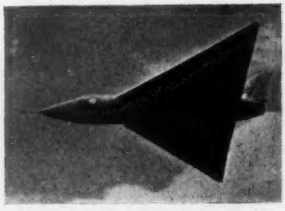
An article by Mr. Ewans, incidentally, appears on pages 172-174 of this issue. In it, a very strong and convincing case is stated for the delta; and the flying demonstration at Dunsfold did much to dispel any doubts which might have existed as to the practical application of such promising theory.

A. V. Roe first set out to prove the case for the delta-wing aircraft as a practical type and not, as might have been supposed, merely to build an idealistic research machine with a delta wing. Thus, in the case of the 707B, with which we are mainly concerned here, the simplest method of feeding air to a well-tried turbojet —the Rolls-Royce Derwent—was employed, namely, by providing scoops above the unit itself. This is housed in the rear fuselage, with the turbine level with the wing trailing-edge. Athena main wheels and legs were quickly available, so they were employed. Similarly, a Hawker P.1052 nosewheel, with lengthened leg, saved time and money as compared with new equipment. Even the control surfaces of this so-called low-speed version of the 707 are surprisingly conventional and operate with normal geared tabs and set-back hinges. Moreover, these controls are ailerons and elevators, operating in exactly the same manner as on a Chipmunk, for example.

The 707B has no flaps, but dive brakes are positioned at about mid-chord, well inboard. These, it was learned, are very effective, producing drag roughly equal to twice that of the whole aircraft. Even so, they do not represent the latest ideas on the subject. The design of effective dive brakes which operate equally well and without undue trim-change over a wide speed range is presenting a problem to many designers.

Because no mention may be made of speeds or other performance, W/C. Falk, the test pilot, was severely limited in the comments he could make. However, he was insistent that any experienced pilot would be able to handle the 707B with confidence in a matter of minutes and with the minimum of briefing. In addition, he stated that the extreme nose-up attitude assumed on take-off and (especially) for landing does not feel or appear out of place to the pilot. View from the cockpit remains good.

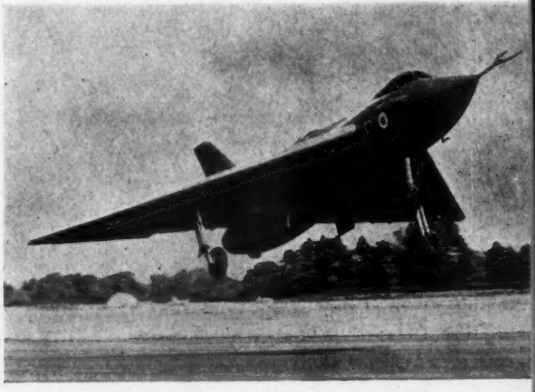
Performance on the power of a single Derwent was noticeably lively for an aircraft which probably weighs about 10,000 lb. The take-off run was shorter than would be required by most current jet fighters, and the climb was remarkably good. On coming in to land, the pilot made his final approach with nose fairly high and speed of about 110 m.p.h. On a demonstration slow fly-past, with everything down, observers guessed the speed to be lower.



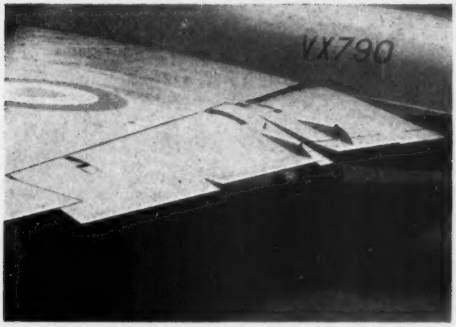
The plan form of the 707 is displayed on a low run. W/C. Falk's aerobatics were a revelation, the rate of roll appearing especially high. Below, the 707B is landing without parachute and the angle of attack is high in consequence.

During the afternoon this "low-speed" machine did some relatively high-speed work, which included immaculate upward rolls and inverted flying, including spot-on turn-unders of the Derry-introduced type. Manœuvrability and rate of roll were both exceptionally good, and a rough timing showed the machine to be capable of a rate of roll in the region of 180 deg/sec.

On one landing the tail parachute was streamed when the machine was being held off, less nose-up than usual, at about 20ft. The deceleration, when coupled with the effect of powerful brakes, resulted in the 707 pulling up within one-third of the runway length (Dunsfold's main E-W runway measures 6,123ft). Having reached taxying speed, the pilot cut his tail parachute loose at almost the exact spot at which he had become airborne.



Note, in this flight study of the 707A, that the intakes have been transferred to the wing roots and that the dorsal fin has been extended forward. The boundary-layer fence in board of the intake stands out sharply in this view. Below, the 707B has conventional aileron and elevators with geared tabs.



All deltas are likely to suffer to some degree from lack of damping in pitch, there being no horizontal stabilizing surface placed well aft of the c.g. This naturally has a bearing on almost all flying manoeuvres but particularly on stalling and spinning, and possibly when flying near the limiting Mach number of the type concerned. An extreme case of such fore-and-aft stability which has been experienced with certain flying-wing-type aircraft, but which might occur—though less readily—with the delta, is known as tumbling. The complete absence of any such unpleasant tendencies during test flying of the Avro delta (which, on the contrary, has proved unexpectedly stable) has caused great satisfaction to those concerned. The demonstrations of slow flying, loops and rolls-off-the-top, and of inverted climbs with negative g, are thus the more significant. Some of the aerobatic manoeuvres were, in fact, attempted for the first time at Dunsfold on the strength of the favourable flying experience to date.

No spinning has been attempted, nor is it contemplated by the company. Even stalling is not considered to be a test requirement in the normal sense, because the attitude of the aircraft at the stall is so exaggerated—the normal landing attitude is illustrative—that no pilot could assume it in any way except intentionally. Experience of control on the threshold of the stall has indicated conformity with predicted behaviour. At the high end of the speed scale performance has been most encouraging, and at speeds a little in excess of the highest Mach number for which the 707 was designed stability has remained satisfactory.

The company is justly proud of the instrumentation devised for the 707. Two automatic recording cameras are installed to cover twenty-four dials.

Regarding the high-speed 707A, which recently flew for the first time, it may be observed from the photographs so far released that there are a number of important differences in addition to the wing-root intakes. It is hoped that this aircraft will be seen at Farnborough with the 707B, though if its appearance threatens to delay development flying, it will not be so displayed.

The wing not only differs in structure, to accommodate the intake ducts, but is seen to carry boundary-layer fences and bleeds at the intakes. The root-profile is also very different from that of the 707B, as are the controls. Ailerons are nearer the modified wing-tip and slightly smaller in area, and a new control visible in the up position in the photograph above takes the place of the inboard portion of the elevators. This surface is basically a flap to assist trim and dive recovery and may be considered, alternatively, as an auxiliary elevator surface. The controls appear to be of the pressure-sealed type as might be expected.

Neither aircraft is pressurized and thus Mr. Falk is in the habit of taking a surfeit of oxygen for an hour or so before high-altitude flights and then putting up with discomfort for short periods at upwards of 40,000ft. It is probable that the 707B will one day be pressurized—possibly as soon as the 707A is in full use and takes over the development flying.

No powered controls have been fitted so far and Mr. Davies believes that these will probably prove to be unnecessary on ailerons and rudder, even on deltas of large size. Elevators will, he considers, need power assistance. Mr. Davies also mentioned the importance, from the control point of view, of thin section and therefore of thin wings. He refers to the 10 per cent wing on the 707B as being, by modern standards, "moderately thin." The finish of the wings and, indeed, the standard of finish of the whole aircraft, is very high indeed. The medium blue of the 707B is particularly attractive, while the 707A is painted a shade of orange, described by Mr. Neville Spriggs as salmon pink.

The 707B will without doubt make a very welcome and exciting new type for display at Farnborough, and it is to be hoped that it heralds much larger delta machines of the kind and efficiency foreshadowed in Mr. Ewans's article.

Landing with the aid of the braking parachute, normally stowed in the tail fairing. The upper dive-brake surfaces are visible on the wing

"Flight" photographs

HERE AND THERE

Armament Standardization

IT was announced last week in Washington that Britain, America and Canada have agreed on the standardization of four types of aircraft bomb: 10,000 lb and 3,000 "high-performance" (for special purposes); 750 lb general purpose; and a 1,000 lb weapon for jet fighter-bombers.

Pulqui II Lost

THE prototype Pulqui II Nene-powered fighter disintegrated recently during an attempt to fly at over 600 m.p.h. A drawing of this Argentine-built aircraft, designed by Kurt Tank, appeared in *Flight* of July 6th, 1951.

British Modellers Win

A FINE achievement was recorded by the British team of six aeromodellers who went to Knocke, Belgium, recently to compete in the world championships for control-line flying. In the seven contests they took six first places, two seconds and a third. All are members of the Society of Model Aeronautical Engineers.

Standard Avons

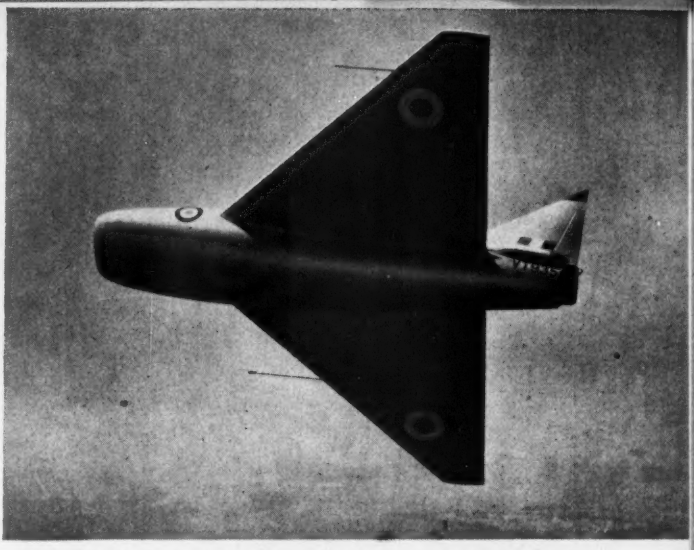
SOME months ago the Standard Motor Co., Ltd., was asked by the Ministry of Supply to submit a scheme for the complete manufacture, assembly and test of Rolls-Royce Avons at its Coventry factories. Sir John Black, deputy chairman and managing director, announced last week that the company's proposals had been accepted. Much preliminary work, it is stated, has already been done, and the ordering and installation of plant and equipment will begin immediately. Incidentally, pre-war motorists will recall that the coupling of the names "Standard" and "Avon" is not altogether novel.

The Job—

GENERAL CARL SPAATZ declared recently, in the American journal *Newsweek*, that in the event of another war the Western Allies' air resources must be consolidated under a single command and employed with the primary object of defeating the enemy's air force. This could not be accomplished by defensive fighter action, but only by mass employment of fighters and bombers over enemy territory. He said that anything like the Battle of Britain could not be repeated and that the defensive fight must be taken deep into Europe and not fought over England. For reasonable security, the general said, the North Atlantic Treaty Organization's air forces in Europe should be built up to at least 100 groups by 1953.

—and the Tools

GENERAL VANDENBERG, U.S.A.F. Chief of Staff, said during a recent congressional appropriation hearing that Russia had developed an air force larger than that of the U.S. It included a counterpart of the American long-range strategic striking force, a type of formation the Russians had ignored during the last war. It was also disclosed during the hearing that the U.S.A.F., under its 1952 budget, proposes to spend £1,770 million to complete 3,092 aircraft now on order, and to place orders for a further 5,064. £1,498 million would be assigned to spare parts. The first four B-52 eight-turbojet high-altitude bombers would cost a minimum of £7,600,000 each; bomb sights alone would cost £89,000 for each aircraft. Figures were quoted to show that cost per aircraft were 100 B-52s to be ordered, would be startlingly low.



EXPLORATORY: This new view of the Boulton Paul P.111 delta-wing, high-speed research aircraft (Rolls-Royce Nene) affords an illuminating comparison with the pictures of the Avro 707 variants appearing elsewhere in this issue. Span is 33ft 6in and length 26ft 1in.

Important R.Ae.S. Lectures

DETAILS of two important lectures are announced by the R.Ae.S. The 39th Wilbur Wright Memorial Lecture (at the Royal Institution at 6 p.m. on September 10th) will be delivered by Mr. A. E. Raymond of Douglas Aircraft; it bears the attractive title *The Well-tempered Aircraft*. The Seventh British Commonwealth and Empire Lecture (at the Institution of Civil Engineers at 6 p.m. on October 4th) is to be given by A. V-M. Sir L. M. Isitt, R.N.Z.A.F.; his subject will be *Air Transport in New Zealand and the South Pacific*.

"FLYING TRIANGLE" DESIGNER: Mr. S. D. Davies, B.Eng., F.R.Ae.S., who, as chief designer to A. V. Roe and Co., Ltd., is responsible for the Avro 707s. He joined the firm in 1938.

IN BRIEF

MANUFACTURERS who intend to exhibit at the 1952 British Industries Fair (May 5th-16th) are advised by the organizers that, unless their applications are received by August 25th, they may have difficulty in obtaining space.

* * *

On its recent Polar flight the Lincoln Aries III carried a Hughes periscopic sextant.

* * *

Douglas Aircraft announce the appointment of Mr. John C. Buckwalter as chief engineer of their Long Beach division. He has been with them since 1929 and was project engineer on the original DC-4.

* * *

A data brochure describing the latest Dumore automatic drillhead, made by the Dumore Co., Racine, Wisconsin, has been issued by the European Distributors, Rocke International, Ltd., 59, Union Street, London, S.E.1.

* * *

Macrome, Ltd., Wolverhampton, announce the appointment of Mr. R. A. Harding as general manager and Mr. N. D. Pentland as sales manager. Mr. P. N. Rogers has been appointed directors' special representative.

* * *

W. T. Flather, Ltd., Standard Steel Works, Sheffield, have produced an informative new 94-page catalogue of their steels, among which are a number of aircraft grades. The book is of loose-leaf form, so that additional data sheets can be issued.

* * *

Beech Aircraft Corporation, of East Central Avenue, Wichita, Kansas, state that a person has been introducing himself to members of the aircraft industry as their representative in this country. They therefore ask us to point out that, while they have agreements with independent distributors in most European countries (England is an exception), they have not appointed agents or representatives. All business should be transacted with the company in America.

SERIAL 3

S.11 TRAINER, HAWKER SEA FURY and GLOSTER METEOR *production — photos by courtesy of N.V. Koninklijke Nederlandsche Vliegtuigenfabriek Fokker, Holland

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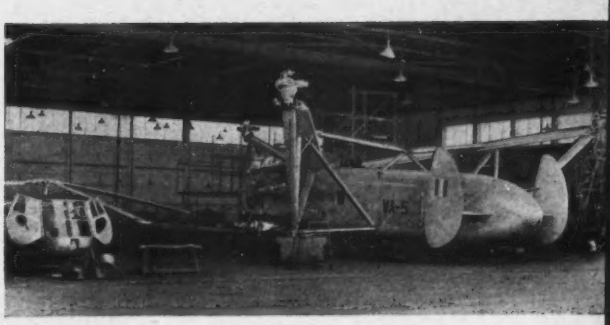
HELICOPTER TESTS BY SARO

Development Work on the Skeeters and Air Horse taken over from the Cierva Company



The remaining Air Horse (minus blades) in the hangar alongside one of the Skeeters. The other big helicopter, it will be remembered, was lost in a crash. Preliminary engine-runs have been made with WA-5.

MANY readers have been wanting to learn of the progress being made with the promising little Skeeter and the remaining Air Horse since development of these helicopters was taken over by Saunders-Roe Ltd. These notes—which we reprint, with acknowledgements, from *The New Slipway* (the firm's house-journal) indicate a very thorough programme. The author is Mr. F. E. Bridges, assistant chief designer, helicopter division.

AT the beginning of this year, Cierva held two Ministry of Supply contracts, one dealing with three Skeeters and the other with one Air Horse. In the case of the Skeeters, it was required that the aircraft be prepared as soon as possible for flight evaluation by A.A.E.E., Army, and Navy; but in the case of the Air Horse, no programme of testing had been laid down, the contract calling only for complete strip, inspection and reassembly. These two contracts were transferred to Saunders-Roe and, in order to carry out the work, Saunders-Roe engaged most of the Cierva design team.

The three Skeeter aircraft were not identical; two had been designed to meet Army requirements and were designated Mk 3, and were fitted with Gipsy Major engines; the third, the Mk 4, had been designed to meet Naval needs and was fitted with a Blackburn Bombardier engine. All three aircraft had previously done some ground running and flying.

An earlier aircraft, a Mk 2, had broken up during ground running owing to unexpected resonance trouble, and the three Skeeters taken over by Saunders-Roe were grounded pending a solution of the problem. After preliminary technical investigations, a programme of test work was drawn up in conjunction with M.o.S. representatives, with a view to getting one of the machines to A.A.E.E. for flight evaluation tests at the earliest possible date. This programme, now partially complete, is still in hand.

It was agreed that the Mk 4 aircraft should be used for ground running vibration tests, that is to say, the machine was to be tied down to the ground and run in the first place for 50 hr and, subsequently, for a further 100 hr with regular inspection periods which were to be utilized for detailed examination of all parts in order to determine not only wear but also any signs of cracks or failure which might tend to occur owing to the vibration and resonance which are present with all helicopters. Early in these runs, partial seizure of the engine occurred, which necessitated changing the unit and occasioned some delay. The trouble was found to be due to a helicopter condition of running which had not occurred during previous flying tests in a fixed wing aircraft; and, as a result, a modification was carried out by Blackburns to all three engines. At the time of writing the aircraft and engine are being subjected to the third periodic strip and, although one or two minor detail troubles have been brought to light, no major sign of failure has shown up.

Of the two Mk 3 aircraft, fitted with the Gipsy engines, one was used for "shaker" tests and the other for ground running to investigate resonance with various chassis "spring" conditions. The "shaker" tests were conducted in the hangar and for this purpose an eccentric rotating mass, electrically driven at various known speeds, was used in order to check vibration and resonance characteristics over the whole air-frame. These tests were carried out in the presence of R.A.E. and M.o.S. representatives and did not reveal any features which were considered such as to necessitate design modification. On completion of the tests, the Gipsy Major was removed and is now being replaced by a Blackburn Bombardier, the aircraft then being designated Mk 3B. During the conversion the helicopter is being equipped with instrumentation and strain-gauging for a thorough investigation, during ground running and flight, of the vibration problem. This work is still in hand, having been delayed owing to difficulties in obtaining some of the necessary items of equipment.

The third aircraft, a Mk 3, was equipped with a Mk 3 undercarriage which was fitted with various springs, but ultimately with some adjusted to the rate of those fitted to the Mk 2. With these latter springs, ground running was carried out at successively increasing rotor r.p.m. until the required 10 per cent overspeed condition had been achieved.

When this had been done numerous times, including a demonstration before M.o.S. representatives, it was felt that a satisfactory chassis had been arrived at. It was then agreed to carry out a short series of tests at 10 per cent over-rev conditions, to prove conclusively whether the chassis was satisfactory or not, and a number of runs were made with the aircraft fully tied down, in the same way as had been used for all previous running. This was followed by a series of runs with the snubbing partly released and then by a further series with the aircraft completely free. Overspeeding having been achieved without difficulty in all these tests, a further short series was carried out, during which the aircraft was lifted from the ground under its own power, placed down again a few feet away and then run up to the 10 per cent overspeed figure.

These tests having been successfully completed, the aircraft was returned to the shops for conversion to Mk 3B by the installation of a Bombardier engine.

It has been laid down that, before any Skeeter can fly again, the ground running aircraft must have achieved a certain minimum number of hours of ground running. This amounts to at least twice as much ground running as has been done by the aircraft which is flying.

The present position is, therefore, that we have one aircraft which is undergoing an extensive programme of ground running, a second one which is being prepared for ground running and flight instrumentation and a third one which is being prepared for evaluation by A.A.E.E.

In the case of the Air Horse, the contract called for a thorough strip and examination following the crash of the original aircraft, which had been completely written off. The crash was due to fatigue failure of a detail. After a complete strip and inspection, the remaining aircraft has been re-assembled, and preliminary engine runs have been carried out.

Instrumentation to a programme agreed with the Ministry of Supply is now being installed and it is expected that ground running and some flying will take place later this year.

The Mk 3B Skeeter on the airfield at Eastleigh. In the background can be seen the "compound"—a safeguard against the effects of rotor-blade failure—in which the ground-running tests are conducted.

D.H.s IN FRANCE

Vampire Production and Plans for Building the Venom

A view from the front of the Vampire 5 production line at Marignane, with aircraft No. 85 nearing the test flight stage. The numbering on the nose commences only with aircraft actually fabricated at the factory and does not include those imported or those rebuilt from parts from England.

ONE of the most heartening sights in France during the present uncertain period is that of the Vampire production line at the S.N.C.A. de Sud Est factory at Marignane, near Marseilles. At the moment only licence-built Vampires F.B. Mk 5 are on the line, No. 100 of these "all-French" machines having just reached the final-assembly stage. The greatest interest lies, however, in the impending production of the Vampire Mk 53 Mistral, the Sea Venom N.F. 20 and the Venom F.B. 1.

When the original licence production contract was drawn up, it was realized that not only would there be difficulty in importing all the Goblin turbojets necessary, but that improved power outputs and performance would be required to meet changing conditions. The decision was therefore taken to incorporate the 5,070-lb-thrust Nene, built under licence by Hispano Suiza. Initial test work was undertaken by de Havilland and Rolls-Royce in fitting the Vampire with the so-called "elephant ear" intakes in order to provide the extra air needed for the rear face of the Nene's double-sided impeller. This type was to have been French-produced as the Mk 51.

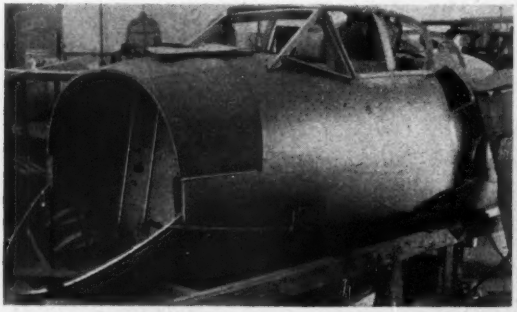
The arrangement proved unsatisfactory for several reasons—particularly with regard to stability. A new way out of the difficulty was sought, and with the co-operation of Rolls-Royce, de Havilland, S.N.C.A.S.E., and Boulton Paul, the split-trunk intake of the Hawker P.1040/Seahawk series was adapted most successfully for use on the Vampire.

The Mistral employs the Mk 5 wing, fuselage, etc., but has certain internal modifications such as cockpit pressurization and the fitment of an S.N.C.A.S.O. ejector seat. Overall performance has been considerably improved, the maximum speed rising from 530 m.p.h. at sea level on the Mk 5 to 575 m.p.h. on the Mistral, and the height gained in 7 min 38 sec increasing from 21,325ft to 32,800ft. With the new power unit and added equipment, the Mistral has an all-up weight of 10,910 lb as compared with 10,470 lb on the normal Mk 5.

So far four Mistral prototypes have been completed and a test flight has yet to be made with an ejector seat fitted. Production versions should begin to appear late in the year, and will be fitted in on the Mk 5 line. At the time of writing France is so short of fighters of any description that the Mk 5s intended for close-support work are being used for "all-altitude" interception. As Mistrals appear, Mk 5s will revert to their proper job, and both types will continue in production concurrently. To speed up production, Mk 5 wings (constructed by S.N.C.A.N. at Meaulte) are being modified to incorporate Mistral intakes, in special jigs set up in the repair and overhaul hangar at Marignane. Eventually Aeronord will deliver fully modified wings.

The exact number of Mistrals to be produced is not yet known, but under the French Government's five-year plan and one later programme some 450 Vampires of all types were scheduled to see service.

As indicated in literature on the Sud Est stand in the recent Paris Salon, the company is to undertake series construction of the de Havilland Sea Venom N.F. 20 for the French Navy. This has not come altogether as a surprise; under thefive-year plan the



(Left) A full-scale mock-up of the Venom N.F.2 now being used at Marignane to test twin ejector-seat installations. The actual seats can just be discerned in the cockpit with a mock-up seat outside. (Right) The second prototype Vampire Mk 51 at Marignane, fitted with a Nene and nostril ear intakes for continued trials. The Vampire Mk 53 (Mistral) has redesigned root intakes.

Government stated that if home-produced prototypes such as the Nord 2200 and the Arsenal V.G. 90 did not show more signs of being useful, then licences for the production of 150 foreign two-seat radar-equipped naval fighters would be sought without delay.

Tooling-up is going on at the Marignane factory for Venom 20 production, but the first aircraft will definitely not appear before well into 1952, and the company will be forced to wait until aircraft can be spared from this country for them to re-assemble and examine.

A Venom 20 fuselage mock-up has been delivered to Marignane, and this is at the moment being used to try out arrangements for latest Martin-Baker ejector seats which will be fitted as standard. It will be remembered that ejector seats are not mounted on Venoms for the Royal Navy and certain headroom difficulties will have to be overcome.

Venoms will be introduced on to the one line in a similar manner to the Mistral, and thus three different types will be in production at the same time. Ghost power plants are to be imported from this country, as with the thin-section wing of the Venom it will be impossible to fit the Mistral intakes to feed the Nene plenum chamber.

Venom F.B.1s are also scheduled to be built at Marignane for the Armée de l'Air, and will eventually replace Vampire 5s and Mistrals. The Naval orders for Mk 20s have priority over the Mk 1s, as it is considered that the Air Force is in a better position to continue utilizing such material as the Mistral, whereas the Navy has no jet aircraft.

D. H. W.

AIR O.P. CAMP

Summer Training with the Handy Mk 6 Austers on Salisbury Plain

THIS year's "open season" on Salisbury Plain has been notable for the number of Auster 6 Observation Post aircraft which have been seen buzzing placidly around the little-used airfield at Netheravon, and occasionally (less placidly) streaking over the tops of Army convoys at zero altitude.

The majority of these camouflaged Austers bearing R.A.F. markings belong to the Territorial Army and R.Aux.A.F. Air Observation Post Squadrons which have been carrying out their summer camps on the Plain. Comparatively little has been said or written about the Air O.P. squadrons and civilians and Servicemen alike are sometimes puzzled by the sight of vehicles carrying a mixture of Royal Artillery and R.A.F. men pulling into farmers' fields, their crews going into frenzied activity with white recognition strips and Aldis lamps, and a few minutes later a stream of Austers piloted by Army officers coming in to land in spaces little bigger than football pitches.

The job of an Air O.P. unit is to observe for field artillery in much the same way as a ground observation post in a slit trench or tank. At present the Auster 6 (Gipsy Major) is the standard aircraft for the job, chosen because it can be flown in and out of any field giving a 200-yd strip clear of obstruction, is highly manœuvrable at low altitudes, and is easily maintained in the field.

All Air O.P. aircraft are flown by Royal Artillery officers—largely because a knowledge of field gunnery is the first essential of the job: flying the aircraft is simply the pilot's method of getting himself into the most convenient position to observe the fall of shot. That may be an over-simplification, however. The Auster is, of course, entirely unarmed and very slow, and an extremely high degree of skill is required on the part of pilots to avoid attack by enemy aircraft and anti-aircraft guns. The Air O.P. pilot's sole defence lies in his ability to fly very low—sometimes only a matter of 30 to 50ft above the ground—in being able to take cover behind woods and hills, and to turn inside the circle of any modern fighter.

Inter-Service map-reading: Members of 1951 Flight, with their Commander, Capt. C. A. T. Wright, on an exercise during the camp period.

The open-air life: "Bedding down" on Auster for the night.

Most of the Air O.P. squadrons in Britain have now been turned over to T.A. and R.Aux.A.F. status. Each squadron has a number of out-lying flights which are actually self-contained units, often based more than 100 miles away from squadron headquarters, and relying on H.Q. only for certain administrative matters. On the ground, the squadrons and flights are composed roughly equally of T.A. and R.Aux.A.F. personnel. The airmen service the aircraft and the Gunners handle all wireless communications and M.T. vehicles.

Because nearly all commissioned officers are fairly heavily committed in flying their aircraft a great deal of attention is paid to making all "other ranks" completely competent in map reading, camouflage, and landing-ground-occupation drill as well as in their own individual jobs as drivers, wireless operators and engine and airframe mechanics. Though many flying hours have been put in by all pilots at this year's summer camps the emphasis has been very largely on the part which the ground crews play in Air O.P. operations.

Each squadron competes in an annual efficiency competition for which a silver cup is awarded and the most important factors are the results of officers shooting on "live" ranges and on a test of the whole unit's general competence, known as "Exercise Algy."

"Algy"—derived from the abbreviation A.L.G. for air landing ground—consists of the occupation of three or more separate landing grounds widely spaced apart while a Regular Army directing staff from the School of Air O.P. at Middle Wallop watches every fine point both from the ground and the air.

The flight commander ("Algy" is usually carried out by one

Truly rural: Air O.P. Austers on a typical advanced landing ground.

AIR O.P. CAMP . . .

selected flight on behalf of a whole squadron) is given full operation orders and a section is then sent off to a map reference to find and prepare a landing ground for the remainder of the flight. The recce of the field is carried out from the air by the section pilot and he will direct his vehicles to it by dropping a message on them at a pre-arranged rendezvous. Remaining vehicles in the flight are also sent off to a rendezvous while the recce is being carried out, and they are usually directed on by wireless.

During the whole of the exercise a member of the Regular Army directing staff flies above to note such points as convoy discipline and the hiding of vehicles and aircraft, while others travel on the ground and listen-in to the wireless net. Various diversions are usually arranged such as the sending off of an aircraft on a recce in the opposite direction to the remainder of the flight to test wireless operators' ability to relay messages over long distances quickly and accurately.

In the live shooting each pilot normally flies two sorties, and various types of target are allotted to each squadron. The shooting is watched by a directing staff team from a ground O.P. which has the target, aircraft and guns in view.

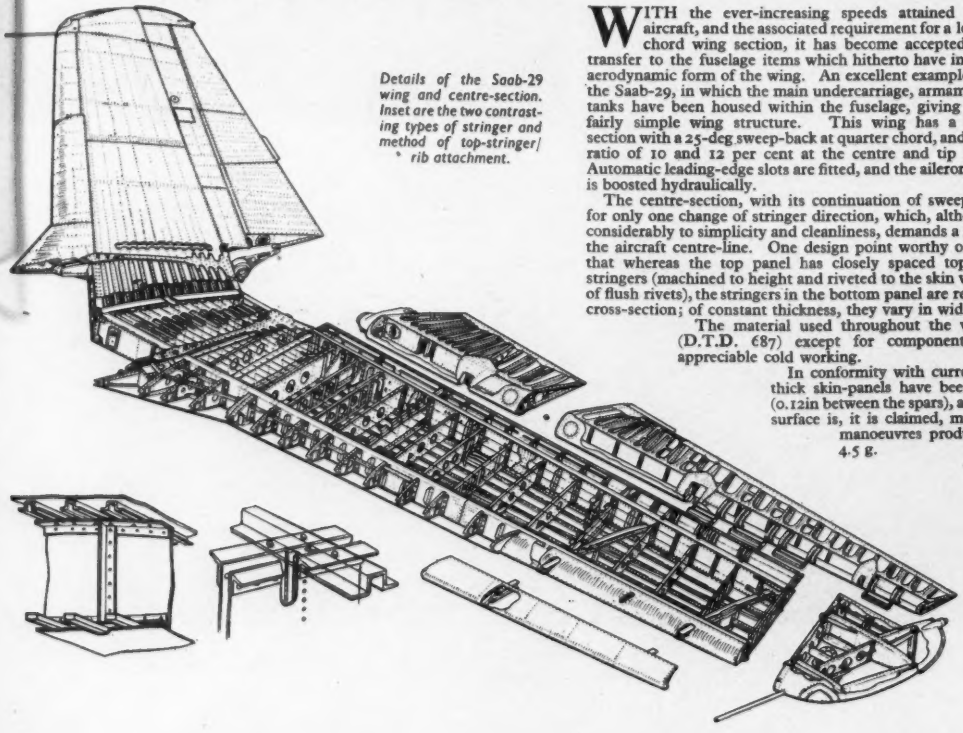
Occasionally a pilot is told that he must assume that there are enemy A.A. guns well forward and that the enemy has a measure of air superiority. This means that the pilot must fly low until the gun position tells him the shot is about to fall and must then climb to observe the shot, and dive down into cover again immediately he has seen it. When enemy aircraft are known to be in the area, rear observers—either Army or R.A.F. other ranks—are carried to give the pilot warning of impending attack.

Marks awarded for "Algy" and for shooting are added to others awarded for recruiting, attendances, and hours flown during the year, and the result of the competition will be made known in the autumn; 1951 Flight, based at Ringway, Manchester, which represented 663 Squadron at camp this year, has high hopes of pulling off the cup following the complimentary remarks of the directing staff after "Algy." Although this unit (of which the writer of these notes is a member) has been formed only just over a year, and has had only one previous summer camp, it was told that it "exhibited all the signs of being well and thoroughly trained," and that its wireless procedure in particular was better than any that had been heard by the directing staff in other Regular or Territorial flights. Maj. J. R. Bandy commands 663 Squadron and 1951's flight commander is Capt. C. A. T. Wright.

Perfect weather for the whole fortnight made training a pleasant business for ground crews and pilots alike. The Austers were seldom on the ground during the hours of daylight and there was a heavy run on face cream (normally kept by the Netheravon Naafi for W.R.A.F. personnel), which was pressed into service as sun-tan lotion.

A number of officers and men from the Z Reserve have been training with the squadrons at Netheravon. Pilots, many of whom have not flown for five or six years, have been given refreshers on Auster 7s, the dual control version of the 6, and then attached to flights for a few days' tactical training.

WING-CONSTRUCTION: A SWEDISH EXAMPLE



Details of the Saab-29 wing and centre-section. Inset are the two contrasting types of stringer and method of top-stringer/rib attachment.

WITH the ever-increasing speeds attained by military aircraft, and the associated requirement for a low thickness chord wing section, it has become accepted practice to transfer to the fuselage items which hitherto have influenced the aerodynamic form of the wing. An excellent example is found in the Saab-29, in which the main undercarriage, armament and fuel tanks have been housed within the fuselage, giving a clean and fairly simple wing structure. This wing has a symmetrical section with a 25-deg sweep-back at quarter chord, and a thickness-ratio of 10 and 12 per cent at the centre and tip respectively. Automatic leading-edge slots are fitted, and the aileron-flap system is boosted hydraulically.

The centre-section, with its continuation of sweep-back, calls for only one change of stringer direction, which, although adding considerably to simplicity and cleanliness, demands a heavy rib on the aircraft centre-line. One design point worthy of mention is that whereas the top panel has closely spaced top-hat-section stringers (machined to height and riveted to the skin with one row of flush rivets), the stringers in the bottom panel are rectangular in cross-section; of constant thickness, they vary in width spanwise.

The material used throughout the wing is 75S (D.T.D. 687) except for components requiring appreciable cold working.

In conformity with current practice, thick skin-panels have been employed (0.12in between the spars), and a smooth surface is, it is claimed, maintained in manoeuvres producing up to 4.5 g.

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The Avro 707 Delta Wing is the realisation of several years of special research. In many hours of flying time it has consistently exceeded all our expectations . . .

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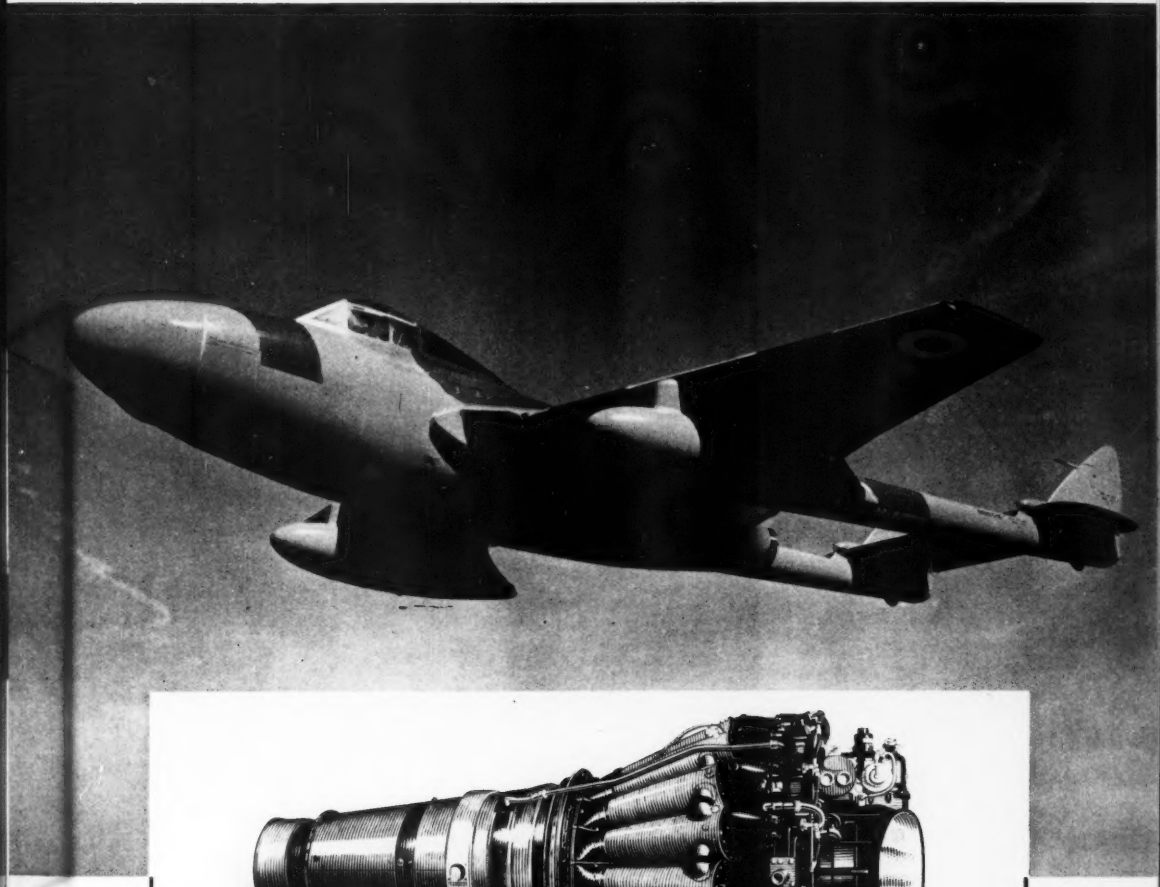

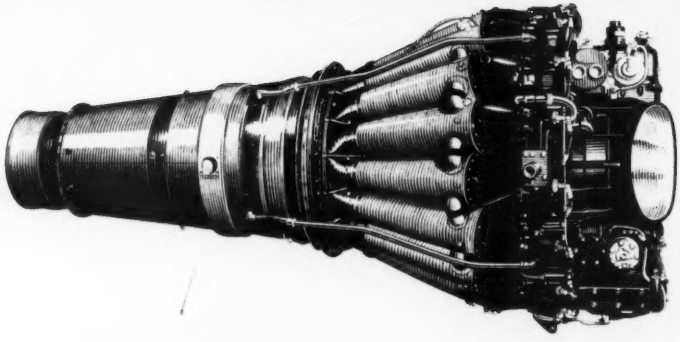

A reliable, established engine with a decade of development behind it, the Goblin is in service in thousands from Sweden to South Africa, from Canada to Singapore and Switzerland. It is in full production at home and abroad to make its contribution to defence needs

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A de Havilland Vampire F.B.5 of the Central Gunnery School, Leconfield, is seen (from a Meteor 7) at R.P. practice.

GUNS, BOMBS, ROCKETS

Illustrated with "Flight" Photographs

Armed with eight 25 lb concrete-head practice R.P.s, a Vampire (above) turns to dive on its target. Below, a Lincoln comes in for rear-turret firing. Reference to a demonstration, during the course of which these and other photographs were secured, was made in last week's issue.

The armourer above is affixing 8½ lb fragmentation bombs to the carrier of a Vampire for a dive-bombing demonstration. Note that the light-bomb carrier is attached to the main (500/1,000 lb) carrier. Below, the 20 mm guns of the Vampire are in process of being re-armed.

A SERIES of important navigational training flights was made recently by aircraft from the Royal Air Force Flying College, Manby. *Aries III* and four other Lincolns, with crews comprising instructors and students from the college, flew first to Keflavik airfield, in Iceland, from where, as reported last week, *Aries III* made a flight over the North Pole to Alaska, a distance of 3,553 miles. The other Lincolns made shorter flights into the Arctic Circle.

The upper series of photographs show, left to right, one of the Lincolns over typical, inhospitable Arctic terrain, *Aries III* and three members of the crew taken by the light of the midnight sun, and a striking portrait of a Lincoln's Rolls-Royce Merlins, upon the reliability of which so much depended. Below is another pleasing in-the-air picture which seems to capture the atmosphere of such flights, and also the concentration of the captain.

In the photographs below one senses the companionship offered by another aircraft when flying over the bleak, lonely Arctic wastes. Particularly uninviting are the mountains, sea and glaciers, said to be near an island called Hold with Hope, depicted in the central view. On the right, *Aries III* and members of her crew are silhouetted against an 11.30 p.m. sun.

ARI

Crews from t

ES OVER THE NORTH POLE

R.A.F. Flying College, Manby, Gain Unique Experience of Navigational Problems in the Far North

(Right) Typical of the Camphill scene is this line-up at the launching point. A Gull IV of the R.A.F. Gliding Association is coming in to land.

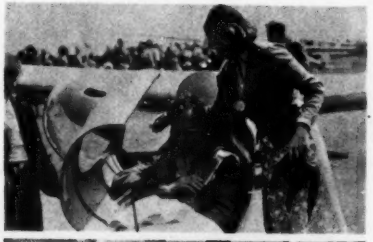
Keen interest is displayed by naval spectators, who include Vice-Admiral C. E. Lambe, Flag Officer (Air) Home, and Lt. Cdr. Peter S. Wilson, a member of the British Gliding Association technical committee. A. Cdre. Vernon Brown, Chief Inspector of Accidents, M.C.A., shades his eyes.

CAMPHILL CAMEOS

Fine Weather Favours the National Gliding Contests

(Report on page 171)

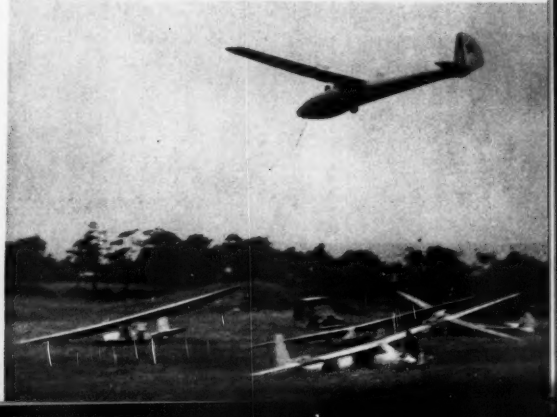
(Right) One of the outstanding performers in this year's competition was Mr. Geoffrey Stephenson, here seen with his wife.

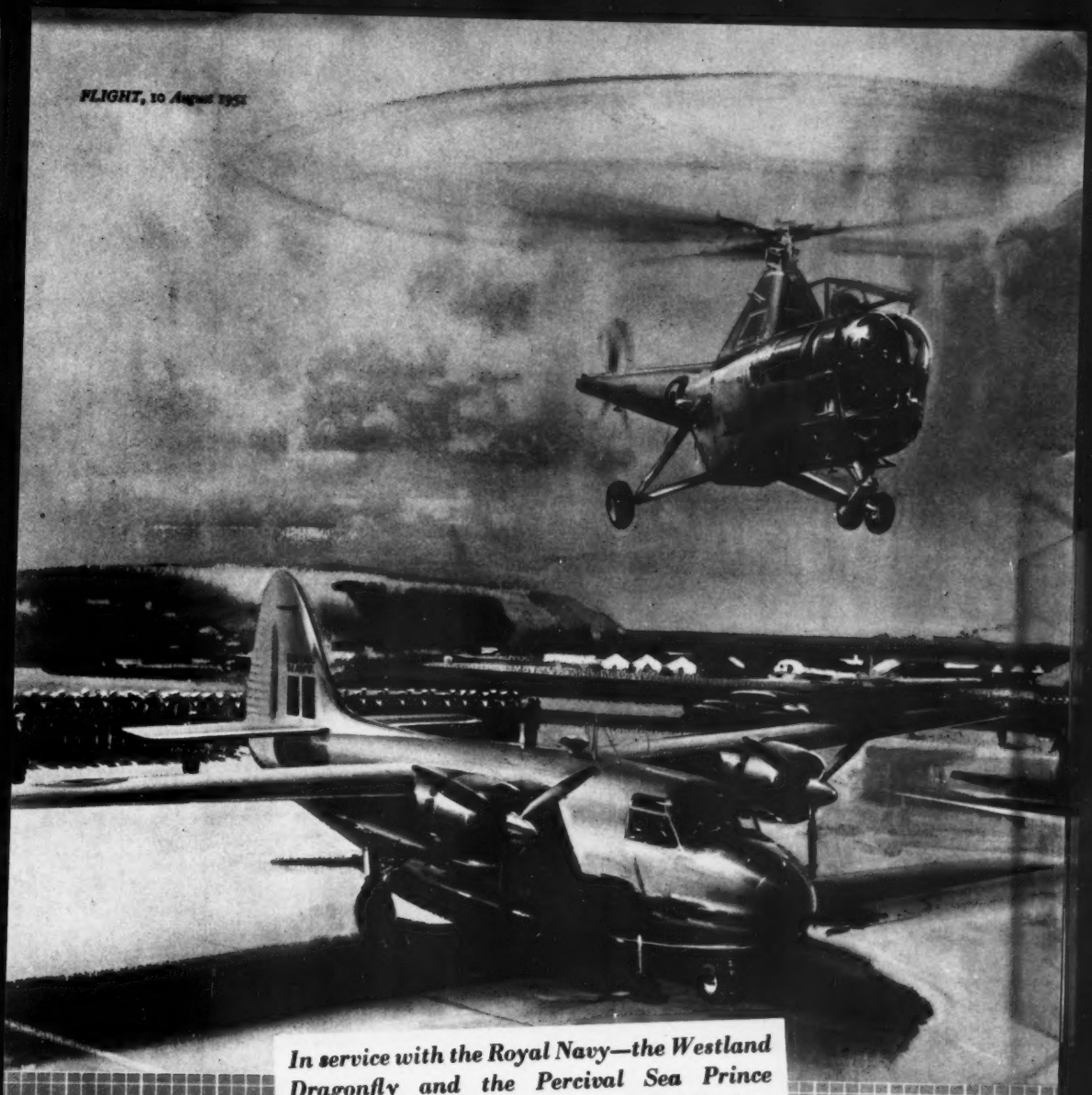


(Right) A great enthusiast, to be found at every gliding meeting, is Mrs. Ann Douglas. Lady Kinloch (left) has paused to wish her luck before take-off.

One of the best known names in gliding is that of Philip Wills, who is here seen above in characteristic flying attire. Below, the two-seat Kronich (R.A.F. entry) is about to land, while in the foreground is the side-by-side T21B Sedbergh trainer, a type which also did a roaring trade in joy-riding.

(Below) One of the highly successful new Slingsby Sky sailplanes—in this case about to be landed by F/L. "Jock" Forbes, one of this year's star performers.





In service with the Royal Navy—the Westland Dragonfly and the Percival Sea Prince both fitted with Alvis Leonides Engines

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CAMPHILL IN RETROSPECT

Further Notes on the Gliding Contests

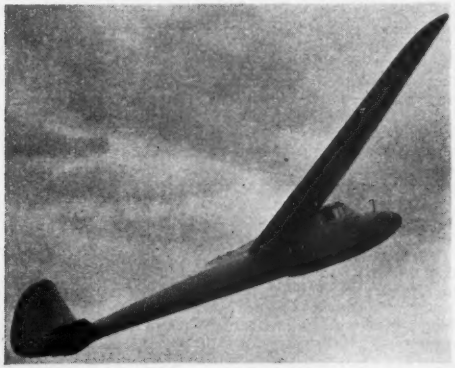
FOR the sixth time in the history of these contests, the Camphill, Great Hucklow, site of the Derbyshire and Lancashire Gliding Club was chosen as the venue for the National Gliding Championships. (A preliminary report, and mention of the unusual result, appeared in *Flight* last week; other photographs will be found on the preceding page in this issue.)

Although there is usually some element of risk attached to the choice of this site from the point of view of weather, this year, as in 1950, the decision proved a wise one; only on one day did the elements prohibit competition flying.

Lying, as it does, on the backbone of high ground which runs down the centre of England, Camphill is considered to be one of the most effective hill-soaring sites in Britain. It has two main slopes, one to the west, known as Bradwell Edge, and a southerly slope, Eyam Edge. Both give good "beats" of about two miles and provide smooth lift most of the time. Thermals are frequent but, because of the topography of the surrounding countryside, thermal lift is often broken.

In the past the site has proved itself excellent for competition purposes and this year was no exception. Thirty-three sailplanes and approximately 70 pilots took part in either team or individual classes. Although, as the results indicated, the standard of soaring was high and several fine individual flights were made, perhaps the most notable feature was the magnificent performance put up by the new Slingsby Sky, for which a C. of A. was forthcoming only three days before the contests began. It is certainly a tribute to its manufacturers that this relatively untried sailplane should have swept the board in the face of such formidable competition as that offered by the German Weihe.

After several days of uncertainty, it was finally announced last Wednesday that the judges had agreed to accept F/L. "Jock" Forbes' claim to have reached the Flamborough Head turning-point, which thus gave him a four-point lead over Geoffrey Stephenson, personally accepted as the provisional winner. The Sky sailplanes flown by both of these pilots gave consistently better performances than did any other individual type. Weihes, piloted by Lorne Welch and Philip Wills, took third and fourth places. No fewer than 16 Eon Olympias took part, most of them flown by Service teams.



The two leading protagonists in the struggle for type honours were (above) the well-proven German-built Weihe and (below) Britain's newly certified Slingsby Sky. The latter proved victorious.

The batsman gives his starting signals to the winch-operator and the great moment has arrived. In a few seconds the pilot will have to rely solely on his knowledge of the clouds to reach a distant goal.

The week began well, with a busy practice day on July 21st. On the following day, Sunday, Stephenson obtained an early lead with a 76-mile goal flight (to a destination chosen by the pilot) during which he reached an altitude of 12,400ft. On Monday, however, the cloud-base ruled out any hope of competition flying.

Stephenson's Sky was again to the fore on Tuesday, winning a hard-fought 110-mile cross-country race from Camphill to Dunstable. His time was 2 hr 35 min, and he covered the distance at an average of 42.6 m.p.h.; Forbes landed a minute later.

Throughout the morning half of the competitors had been soaring at low altitudes over Bradwell Edge in a north-easterly wind which made it impossible to climb higher because of a considerable amount of layer cloud. On Wednesday, Stephenson was the only one of 35 starters to reach the turning point in the 144-mile out-and-return race to Boston; on the return leg he made 18 miles.

Thursday saw the longest "distance" of the whole meeting, recorded by Lorne Welch in a Weihe. He struggled hard against awkward cross-winds to reach his chosen objective of Lympne, but failed by ten miles, finally landing at Manston airfield. All of the other competitors went in a northerly direction, only two of them making flights of more than 100 miles. The Weihe contingent again moved forward on the Friday, when Philip Wills achieved an excellent 75-mile "distance" hop to Loughborough, Yorkshire.

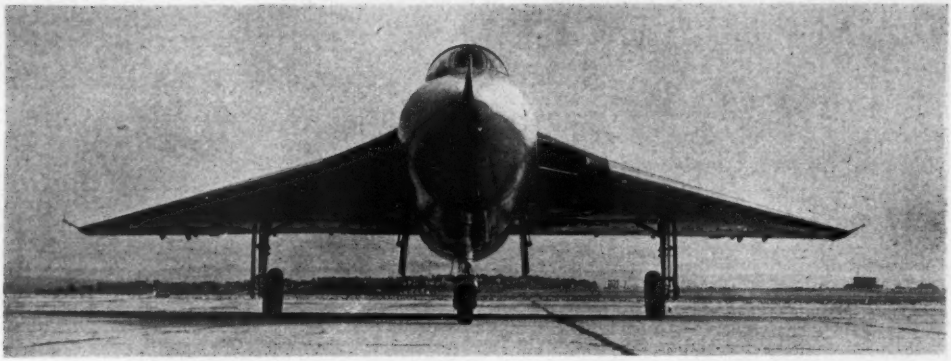
Saturday's task proved a difficult one, a strong and tricky head-wind preventing all competitors from completing the return leg from Boothferry Bridge, near Goole, 45 miles from Camphill. Of the 13 pilots who succeeded in getting there only David Ince and Philip Wills made any sort of distance on the return leg.

Although at this stage Geoffrey Stephenson was still leading he was unfortunate in having flown with an unserviceable barograph; without this piece of bad luck he would, undoubtedly, have gained enough points to prevent Forbes from challenging his total. It was apparent, therefore, that the eventual winner was to be decided entirely by the race held on the final day, and the early-morning prospect of excellent soaring conditions gave rise to an atmosphere of tense excitement among all competitors. The race was to Derby airfield and back, a distance of 60 miles. Twelve pilots completed the course, Maj. A. J. Deane-Drummond of the Army Gliding Club getting away first and making the best time of 2 hr 10 min (an average of 27.7 m.p.h.).

Stephenson was late in getting into the air and was unable to complete the return leg; only another seven miles would have won him the individual championship outright. Forbes, who has had considerable experience of hill-soaring in B.A.F.O., had been plugging away in a steady if unspectacular fashion throughout the contests, recorded a time of 3 hr 18 min for the race, thus earning himself sufficient marks to beat Stephenson at the post.

Besides attaining third and fourth places in the Individual classes, German-built sailplanes, an Mu13 and a Meise (in the hands of the Goodhart brothers) succeeded in carrying off the team championship.

Certainly, from the competitors' viewpoint it was a most satisfactory week's soaring and a great encouragement for all whose energy and enthusiasm go to make these annual contests possible.



Frontal aspect of the Avro 707A research aircraft. New views of the 707B appear elsewhere in this issue.

AERODYNAMICS OF THE DELTA

Some "Background" from J. R. Ewans, Avro's Chief Aerodynamicist

SO far as can be ascertained, the idea of using a triangular plan-form for aircraft wings, now known as the delta wing, was first put forward in 1943 by Professor Lippisch, who will be remembered for his association with the Messerschmitt Company. His studies had led him to think that this form was most suited for flight at speeds in the region of the speed of sound, where conventional aircraft designs were already known to be in trouble. By the end of the war, he had a number of delta wing projects in hand, including an unpowered wooden glider intended to explore the low-speed properties of the wing. This was by then partly built, and was later completed under United States orders.

The idea of the delta wing was studied by many other aeronautical experts and a strong recommendation for its use was given, for instance, by Professor Von Karman, of U.S.A., at the 1947 Anglo-American Aeronautical Conference.

At the time of writing, three British delta aircraft and two American are known to have flown, and it is pretty certain that others are on the way. In the date order of their first flight, these are: Consolidated-Vultee XF-92, Avro 707, Boulton Paul P111, Douglas XF-3D, and Fairey FD-1.

With the exception of the last-named, which is fitted with a small fixed tailplane for the first flights, all the above aircraft are tailless.

The following notes are intended to give a logical explanation of why there is this considerable interest in the delta wing, and just what advantages it promises the aircraft designer. But consideration must first be given to the type of aircraft the designer is trying to produce.

The delta wing is of value only for very-high-speed aircraft and at the present stage of engine development this implies the use of jet engines. When projecting his high-speed aircraft, the designer will attempt to produce something carrying the greatest payload for the greatest distance, at the highest speed, and for the least expenditure of power (i.e., using the least amount of fuel). This applies to all types of aircraft, whether they be bombers in which the payload is bombs, or civil aircraft in which it is passengers or cargo, or fighters in which it is guns and ammunition.

The most fundamental factor determining the ultimate achievement is the height at which the aircraft flies. As height increases the density of the air is reduced, so that drag is less; it is possible to fly at a given speed at say, 40,000ft, for an expenditure of only one quarter of the power required at sea level.

The advent of the jet engine has enabled the aircraft designer to get his aircraft up to considerable altitudes and take advantage of the reduced drag, but a new factor is coming in to limit the speed of the aircraft. This is the speed of sound.

The speed of sound occupies a fundamental position in the speed range of aircraft. It is roughly 760 m.p.h. at sea level and falls off to a value of 660 m.p.h. at heights above 36,000ft. Because the speed of sound is of such importance, aircraft speeds are commonly related to the speed of sound, using the term Mach number (the ratio of the speed of an aircraft to the speed of sound at the same height). As an aircraft approaches the speed of sound—in fact, for conventional aircraft when a speed of about 70 per cent of the speed of sound (Mach 0.7) is reached—the effects of compressibility become important, for the characteristics of the airflow change fundamentally. There is a very large increase in the air resistance, or drag, and an excessive expenditure of power becomes necessary to increase the speed any further.

For transport and bomber aircraft the speed at which the drag starts to increase (known as the "drag rise" Mach number) becomes the maximum cruising speed, because, if the aircraft is flown at higher speeds, the disproportionally higher thrust required from the engine means excessive fuel consumption and loss of range. At a rather higher Mach number there will be changes in the stability of the aircraft and in its response to the pilot's control—leading, possibly, even to complete loss of control.

In order to progress to higher speeds it is, therefore, necessary to design aircraft so as to postpone and/or overcome these effects.

We have noted that with an "old-fashioned" type of aircraft design, i.e., that of jet-propelled aircraft current in 1945, the limiting speed in steady cruising flight is likely to be a Mach number of 0.7 (higher speeds have, of course, already been achieved and a number of aircraft have exceeded the speed of sound, but only for short periods, either by diving or by use of rocket power). However, from the knowledge now available, it appears possible, by careful aerodynamic design, to postpone the rise in drag until a Mach number in the region of 0.9 is reached, and this figure is likely to be the practical limit of cruising speed for transport aircraft of all types for many years to come. The designer of a civil aircraft, a bomber, or a long range fighter, will, therefore, bend all his energies to achieving a Mach number of this order without any drag rise. In addition, he must pay attention to the changes of stability or lack of control which might occur in this region, and this will occupy his attention to the same extent as the purely performance aspect of the drag rise.

It is quite easy to design a fuselage shape which is relatively immune from Mach-number effects. It is the design

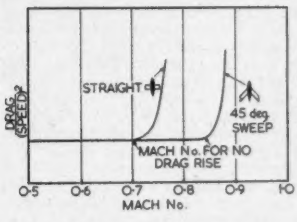


Fig. 1. Comparisons of drag rise of an unswept wing and one with 45 deg of sweep-back.

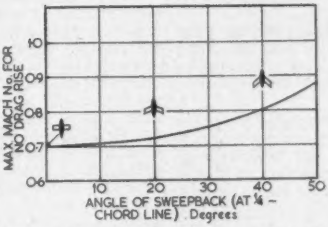


Fig. 2. The effect of sweep-back on the Mach number for no drag rise.

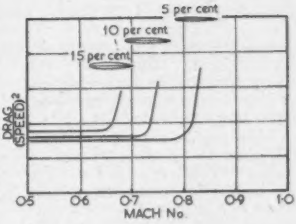


Fig. 3. Effect of thickness : chord ratio on the Mach number, for no drag rise.

of wings which is difficult, particularly since a wing that is suitable for high speed must also give satisfactory flying properties at low speeds for take-off and landing.

As air flows past a wing its speed is increased over the upper surface to a considerable extent and over the lower surface to a less extent, so that there is a greater suction on the upper surface than on the lower surface. Thus, at whatever speed an aircraft is flying, the speed of the air around the wing will, in fact, be higher. In the case of an aircraft flying at a Mach number of 0.8 the speed around its upper surface may be equal to the speed of sound, or may easily exceed it. At this stage, the airflow pattern round the wing will be considerably changed and it is, in fact, this change which gives rise to the drag and stability effects mentioned above. It is essential, therefore, to keep the velocity above the wing as little in excess of the speed of the aircraft as possible.

There are four ways of improving the behaviour of a wing. They are different methods of keeping down the air velocities, and all can be applied simultaneously : (1) sweep-back; (2) thinness; (3) low wing-loading; (4) low aspect-ratio.

(1) *Sweepback.*—The amount of sweep-back is measured by the angle by which the tip of the wing lies behind the centre line. The extent of the gains possible from sweep-back is very considerable, and sweeping back a wing may easily lead to a postponement of the compressibility effects by a Mach number of 0.1. This is illustrated in Fig. 1, which compares the drag rise of an unswept wing with that of a wing swept back 45 deg. The drag rise of the former occurs at 0.7, and the latter at 0.83. Fig. 2 shows the way in which the drag-rise Mach number is increased by sweep-back.

(2) *Thinness.*—Keeping a wing thin leads to a reduction in the amount of air that must be pushed out of the way by the wing, and this helps the passage of the wing through the air. The thickness of a wing is measured by the thickness/chord ratio, which is the maximum depth of the wing divided by its length in the line of flight. In the past, the thickness/chord ratios of aircraft wings have ranged from 21 per cent down to perhaps 12 per cent. Now values of 10 per cent down to 7 per cent are becoming common. An indication of the result gained is given by Fig. 3.

(3) *Low Wing-loading.*—The wing loading is the weight of aircraft carried by a unit area of wing, measured in pounds per square foot. Mach-number effects are postponed by keeping the wing loading as low as possible, i.e., by supporting the weight of the aircraft with a large wing area. This is particularly important for flight at high altitudes where the low air density puts a premium on keeping the wing-loading low. In fact, flight at high altitudes becomes virtually impossible unless this is done. (Fig. 4).

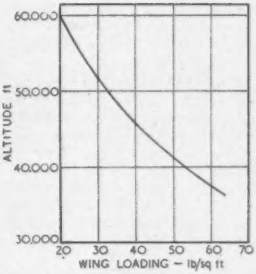
(4) *Low Aspect-ratio.*—Aspect-ratio is the ratio of the span of a wing to the average chord. For moderate speeds, a high aspect-ratio, i.e., a large span relative to the chord, gives greatest efficiency. At high Mach numbers this consideration is no longer important—in fact, some alleviation of compressibility effects is given by reducing aspect ratio (Fig. 5).

There is another reason for choosing a low aspect-ratio. One of the disadvantages of sweeping a wing back is that the flying characteristics at low speed become poor. A typical symptom is that the wing tip of a swept wing stalls, giving violent behaviour if the speed is allowed to fall too low. Research has, however, shown that this bad characteristic of highly swept wings may be overcome relatively easily. Fig. 6 is a graph of sweep-back versus aspect-ratio, compiled from a very large number of tests of wings of various plan-forms. Each of these forms has been classified as giving good or bad characteristics at the stall, and the line shown is the boundary between the good and the bad characteristics. It will be noted that although almost any aspect ratio can be accepted with an unswept wing, for wings of 45 deg sweep-back an aspect-ratio of little over 3 is the most satisfactory.

There is yet a third reason for choosing a low aspect-ratio—the behaviour (as regards stability, etc.) in the high Mach number region. Compressibility effects are minimized and a transition from speeds below that of sound to the speed of sound and above is much more readily accomplished if the aspect-ratio is low, say in the order of 2 to 4.

Put the above four requirements together, and the result is an aircraft highly swept back, with a thin wing, a moderately large wing area and a low aspect-ratio. A little consideration of geometrical properties and possible plan-form of wings leads to the conclusion that the delta wing is the only form which satisfies these requirements. It possesses high sweep-back and low aspect-ratio. The wing area will, of necessity, be generous for the size of aircraft and, for reasons which will be detailed later, it is easy to build it with a low thickness-chord ratio.

Next, how does the delta plan-form, indicated from



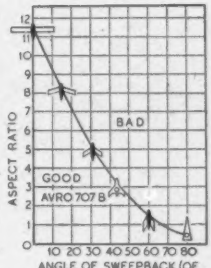
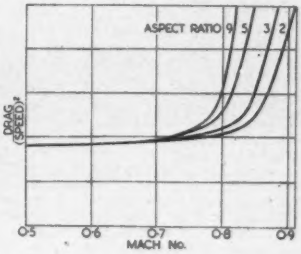


Fig. 4 (above). Value of low wing - loading at high altitudes. Fig. 5 (right). Compressibility effects alleviated by reduced aspect-ratio. Fig. 6 (top right). Sweep-back v. aspect-ratio.



AERODYNAMICS OF THE DELTA . . .

considerations of aerodynamic performance, line up with practical design requirements and, in particular, the overriding necessity for keeping weight and drag low in order to obtain maximum performance? A preliminary question is whether a tailplane is necessary.

From the earliest days of flying, the question has been raised as to whether aircraft can be flown satisfactorily without a tailplane. Confining attention only to the case of the high-speed jet aircraft, each of the functions of a tailplane will be examined in turn in relation to the delta wing aircraft. The functions are :—

(*a*) *To trim out changes of centre of gravity position according to the load carried and the consumption of fuel.*—Investigation shows that a control surface at the trailing edge of the wing, provided that the latter has a large root chord (as has the delta), can cater for all but extreme c.g. movements.

(*b*) *To deal with trim changes due to landing flaps, etc.*—With the low wing-loading associated with the delta wing, take-off and landing speeds are moderate without the use of flaps, and this question does not, therefore, arise.

(*c*) *To provide damping of pitching oscillations.*—The reduction of damping of the pitching oscillation has led to difficulty on some tailless aircraft, but it does not arise on the delta, since the large chord near the root gives adequate damping.

(*d*) *To deal with loss of stability or control power consequent on distortion of the wing structure at high speed.* ("*Aeroelastic distortion*").—At very high speeds, all aircraft structures distort to a greater or less extent under the high loads imposed, and this distortion alters the aerodynamic form. In extreme cases this leads to loss of stability or control power, making the aircraft dangerous or impossible to fly at high speeds. An aircraft with a high aspect-ratio, swept-back wing would need a tailplane to deal with this, but the shape of the delta wing makes it extremely stiff, both in bending and in torsion, and a tailplane does not appear to be necessary.

(*e*) *To provide for spin-recovery.*—Although this point has not been proved, it is expected that the controls on a tailless delta wing would not be powerful enough to ensure recovery from a fully developed spin. A tailplane appears to be the only way of dealing with the problem. This restriction is of small significance for transport or bomber-type aircraft.

It can, therefore, be concluded that for a delta-wing aircraft of the transport type a tailplane is unnecessary. Its deletion leads immediately to a considerable saving of weight and drag, and to a major gain in performance.

We have now shown that, compared with a conventional aircraft, the delta-wing aircraft will be simpler by the omission of the following items : the tailplane; the rear fuselage necessary to carry the tailplane, and wing flaps and other high-lift devices such as the drooped wing leading edge. There is a saving of weight, of design and manufacturing effort, and of maintenance when the aircraft is in service. These economies will have a considerable bearing on the initial cost and the man-power necessary to produce and maintain a number of aircraft.

Because of its shape, and the large root chord, the delta wing provides a large internal volume in relation to its surface area, even when using the thin sections which, as noted above, are essential for high-speed aircraft. Simple calculations show that for the same wing area, the delta wing has 33 per cent more internal volume than an untapered wing, while, if the inboard half of the wing only is considered (as this represents a more practical case from the point of view of the aircraft designer) the internal volume of the delta wing is more than twice that of the corresponding untapered wing.

It is found that without exceeding a wing thickness of as little as 8 to 10 per cent, it is possible on a moderate-sized delta-wing aircraft to bury completely the engines, the undercarriage, and sufficient fuel tanks for long range. The fuselage also has a tendency to disappear into the wing at the root.

The result is the attainment of an aircraft consisting only of a wing, a fin and a rudimentary fuselage, representing a degree of aerodynamic cleanliness which has never before been reached. In fairness, it must be pointed out that this is achieved at the expense of a rather larger wing area than usual, but investigation shows that the drag of this area is less than that due to a conglomeration of items such as engine nacelles, tailplane, etc.

From the design point of view, the shape of the delta wing leads to an extremely stiff structure without the use of thick wing skins, and strength becomes the determining feature rather than structural stiffness. This avoids the inefficiency of conventional swept-back wings where the wing has to be made stronger than necessary in order that it shall be stiff enough.

Summing-up, it can be said that in order to meet the requirements of large loads for a long range, at high speed, the high performance transport or military aircraft of the future will cruise at a considerable altitude, at a speed not much below that of sound. The delta wing provides the only satisfactory solution to these requirements, for the following reasons :—

(1) It meets the four features necessary for avoiding the drag rise near the speed of sound, i.e., it is highly swept back, it can be made very thin, the wing loading is low, and the aspect ratio is low.

(2) Extensive wind-tunnel and flight tests have shown that the low-aspect-ratio delta wing gives minimum changes in stability and control characteristics at speeds near the speed of sound.

(3) In spite of the wing being thin, its internal volume is large, so that the engines, undercarriage, fuel, and all the necessary equipment can be contained within the wing and a rudimentary fuselage.

(4) Adequate control can be obtained by control surfaces on the wing, thus eliminating the need for a conventional tailplane. Together with item 3, this leads to a considerable reduction in the drag of the aircraft, and, therefore, to high performance.

(5) Auxiliary devices such as flaps, nose flaps, or slots, and the all-moving tailplane, are unnecessary, thereby saving weight and design effort, and simplifying manufacture and maintenance.

(6) The delta wing is very stiff and free from distortion troubles.

"NO HIGHWAY" ON THE SCREEN

ALTHOUGH Nevil Shute's novel *No Highway* was concerned with aviation and the plot hinged on the uncertainty of metal fatigue, it was quite unnecessary for readers of the book to have even an elementary knowledge either of the industry or of science in order to enjoy an exciting and satisfactory story. In making a film of the book, however, considerable liberties have been taken by Twentieth Century-Fox with the central character—Theodore Honey, the absent-minded, eccentric research worker at the Royal Aircraft Establishment, who has been turned into a Rhodes scholar, in order, we presume, to explain away the "folksy" accent of Mr. James Stewart in the part. No effort is made to explain the change in Mr. Honey's physical appearance which, if our memory serves correctly, Mr. Shute summed up as "little" and "frog-like." Even if Mr. Stewart has any enemies, the worst of them would not describe him thus; yet Miss Marlene Dietrich (as Monica Teasdale) is obliged to call him "a funny little man."

The technical matter included in the film script can hardly be regarded as entirely satisfactory. Since interest has to be focused on the possible failure of the new Reindeer aircraft's tail structure it was, perhaps, necessary that the design of this unit should be arresting. Yet that would not seem reason enough for "designing" a hideous fantasy which, structurally, does not appear as though it would stand up to the vigorous stampings of a ten-year-old child, and aerodynamically is enough to bring one out in a cold sweat. The faked take-off and landing of the Reindeer was a decidedly dicey affair, which Messrs. Waygood-Otis might well envy.

The wrecking of the Reindeer by Mr. Honey was convincing, an epithet that can less truthfully be applied to the interior scenes in the aircraft, which has a cockpit rather like the console of a cinema organ (veneered hardwood with nooks and crannies), nor of some of the technical dialogue, during which flying-boats, airscrews and piston engines are airily dismissed as obsolete.

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SHEFFIELD

AIR RACING RAINY SEASON

"Daily Express" Contest Postponed: National Races Now Cancelled

Typical of the scene in the aircraft park during the more hopeful mid-morning period. Note Chilton No. 7 with bubble enclosure, and next to the Proctors of Prince Alexander (67) and "Timber" Wood (71), the French Lignel with inverted V.8 Mathis engine. ("Flight" Photograph)

WHAT has air racing done to deserve such vile luck? Last Monday, August Bank Holiday, when the *Daily Express* Race should have taken place, it was almost the story of the King's Cup all over again; low cloud, rain and hopes which slowly but surely became damped as each bulletin told of continuing unsuitable conditions and of a further fifteen minutes or one hour delay. Once during the afternoon a slight clearance was noted at Shoreham, and it did seem as if competitors would be able to get away. The first few on the line started up in anticipation, but the "walkie-talkie" marshals received later orders and the well-tuned if vintage engines were silenced again. From the end of the breakwater at Newhaven—a few miles eastward, where competitors would have turned on to the cross-country leg of the course—the coastline could be seen clearly enough; but inland the clouds were mantling the hill-tops.

At 4.30 p.m. Jeffrey Quill took off in his Spitfire 22 to go round the course in the reverse direction and get an "actual" on the weather conditions. When he turned back after 15 minutes' flying down the coast past Beachy Head, any hopes that were still entertained were given up and talk turned to the evening party and the possibility of arranging the race on another day.

During the morning the work of preparation had gone on—the aircraft to be at their best and the newly formed South Coast Club to be at its most hospitable. Officials raced around and prepared for the briefing in the imposing, though slightly battered, Shoreham Airport building.

In addition to giving time for more than the usual quota of speculation as to the would-be winner, the postponements afforded an opportunity—for those willing to brave the rain—to study some of the rarer specimens arrayed on the starting line. Several smart old-timers and biplanes were entered, among them Capt. Gillman's Avian with front cockpit carefully faired in.

The two smallest aircraft attracted attention, Kendall's Chilton chiefly because of its immaculate condition, and modern bubble enclosure (can that minute warped-profile airscrew really produce enough thrust to give 117 m.p.h.—the figure mentioned?), and Cole's familiar Comper Swift, this time with Pobjoy Niagara engine, giving some 8 h.p. more than the "R" fitted for previous races provided that the magnetos are behaving. Another lightweight, seldom seen but always admired, was the Moth Minor Coupé to be piloted by Fillingham.

Something of an old faithful is Mrs. Grace's Taylorcraft Plus D, which had a truly auxiliary tank harnessed on the passenger seat and feeding into the filler cap in front with the aid of rubber tubing and a car-type hand pump.

From Norway came Capt. Jan Christie, who expected to get about 128 m.p.h. out of his 105 h.p. Hirth-powered Klemm K.1. But for approval and licensing difficulties in Norway, he told us, he would have gone in for more elaborate "mods" in preparation.

Unfortunately the Miles Aries was not seen at Shoreham, being still engaged on building up hours for its C. of A. The pilot-owner, Mr. Cayzer, also, was said to be unwell. However, Fred Dunkerley's Gemini was there, now carrying flush strips at the joints of the rear control surfaces and fairings between the slats and fuselage nose. Everyone was pleased to see Nat Somers back in the game. He has practically recovered from his spinal-disc trouble and his Major-Gemini looked well, too.

To competitors and all enthusiasts alike, one of the main disappointments was in not being able to see the two sleek Italian Ambrosinis (one with Gipsy Queen 30 the other with Alfa 115 ter) and the smart French Lignel perform. The Lignel achieved 163 m.p.h. in last year's race.

A word of sympathy must be added for Hugh Scrope, who severely damaged (not quite beyond repair) his precious Mew Gull when he became ditched after an over-long landing-run on arrival at Shoreham field. Luckily he was unhurt himself.

One of the attractions for holiday-makers on the South Coast was to have been a fly-past by a Comet. Although the aircraft ventured over at low altitude, very few saw it—Shoreham only heard its whine through the commentary loud-speaker network. It was from this quarter also that competitors and others learned of the sad plight of the members of the Observer Corps who, drenched and without shelter, vainly awaited the arrival of the aircraft at the various observed points.

Once more then, the patient and willing officials, having seen most of their work wasted for a second time in the season, will get down to the preparations for a new South Coast Express Race—now fixed for September 22nd.

1951 National Air Races Cancelled

THE Royal Aero Club announces that it has now "reluctantly decided to abandon" the 1951 King's Cup and other National Air Races, postponed on June 23rd owing to adverse weather. Arrangements had been made to hold the races on the first "public" day (Saturday, September 15th) of the S.B.A.C. Farnborough Show.

The Commissioners of Customs and Excise informed the S.B.A.C. that if the races were held in conjunction with their Flying Display and Exhibition the Society would be liable to pay entertainment tax at the maximum rate. It has been calculated that such a sum would amount to over 42 per cent of all receipts from the sale of public admission tickets on that day. The R.Ae.C. announcement says that while the Society, as a loyal supporter of the R.Ae.C. and of British sporting flying, might be prepared to carry this financial burden, it "takes the strongest exception in principle to such extortionate taxation of air racing" and has accordingly informed the Club that it is not prepared to accept this liability.

It is assumed that the Commissioners based their decision on the Finance Acts which, while permitting reduced entertainment duty in respect of certain entertainments, specifically exclude racing or trials of speed of aircraft.

The R.Ae.C. has made some detailed comments, as follows, on the unfairness of the imposition:—

(1) By its very nature, air racing cannot be restricted to spectators who pay for admission. Moreover, in the interests of safety, air races cannot be flown over courses confined to the airfield of start and finish, and therefore the public who pay for admission only see a small part of the race.

(2) Air races are highly dependent upon weather conditions and it may be impossible to hold a race in conditions when any other form of race could take place; thus the organizers' financial risks are greatly increased.

(3) An air race is generally but one item in an air display programme, yet the display thereby becomes a "race meeting" and therefore liable to the highest rate of duty.

(4) Air races are primarily organized for the encouragement of air-mindedness and aviation development, but the organization necessary for the safety of the public and the competitors is such that even without payment of entertainment duty air racing is not a profitable proposition for the promoter.

During the 1950 National Air Races, British racing pilots won five international speed records from other countries. British air racing is a distinct national asset, particularly in times of stress, such as those in which we live, because it encourages the training at their own expense of men whose experiences would be invaluable to the fighting Services in war. A very high degree of skill and technical knowledge is required for successful air racing and it should be encouraged rather than regarded as an entertainment subject to duty.

If the Entertainment Duty at this prohibitive level continues to apply to air racing it will be financially impossible for aeroplane Clubs to promote air races; and air racing, in which Great Britain could lead the world, will be taxed out of existence. This can only result in a grievous loss to British Aviation, both civil and military.

Commercial Aviation Commentary

By ALLEN GALE

No. 4 of a New Series

A RECOMMENDATION by the court which enquired into the Dakota accident at Mill Hill suggested that further study should be given to the question of co-pilots taking off and landing airliners. Certain sections of the Press saw fit to sensationalize this issue and many people must have received the impression that B.E.A. was lax in its acceptance of the principle that co-pilots should be allowed to fly passenger aircraft during the critical moments of take-off and landing, especially in bad weather.

There is no doubt, of course, that the captain is better equipped to fly an aircraft than are his junior crew; and it could be argued that since this is the case it is better if he fly it at all times except during *en route* periods, leaving the training of 1st officers to the appropriate department. But the problem is not one for such easy solution. No amount of circuits and bumps on training can really simulate the conditions obtained in actual airline operation. Take-offs and landings around the same airfield tend to become so routine that a pilot measures his approaches by the surrounding landscape. He puts his wheels down at the cross-roads and his flaps down at the local, and if he is at a certain height when passing over a certain elm tree he knows that his approach is good. Such methods lead to good work in the school but not necessarily on the routes.

The real hard work comes when the things that have been learned have to be put into practice in conjunction with other factors involved in airline operation. There is no substitute for experience here and the only way to teach a man to handle an aircraft properly on the air lanes is to let him fly on them.

It is generally recognised today that co-pilots must be kept in practice insofar as handling the equipment is concerned and captains are being urged to allow them not only to fly under good weather conditions but to allow them to carry out actual instrument approaches, if necessary, taking over for the landing when visual contact is made with the ground. Under this policy there is no doubt that the co-pilots are becoming much more experienced than were their counterparts of ten years ago. It contributes greatly to the all-round efficiency of the airlines, since it means that a fully-qualified man is available in the event of sickness overtaking the captain; that he can be of more value to the latter, because of his greater appreciation of the problems involved; and that he can fall back on a sizeable degree of practical experience when it comes to his turn to assume the status of commander.

There is one point here which might well be studied by aircraft designers. It is accepted practice to equip all but the smallest transport aircraft with dual controls. For some reason, however, this arrangement has not been carried forward where nosewheel-steering is concerned, and in all the cases of which I know only the captain has such a control. It should not be difficult to fit an additional wheel which could be operated by the co-pilot; and if this were done at least some of the necessity for pilots to change seats in the circumstances discussed above would be avoided.

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I WAS interested to hear that the Howard Hughes Hercules is to be rejuvenated. It will be remembered that this 400,000-lb flying-boat originally came into being because of the dream of a certain Mr. Kaiser that large aircraft could be built as quickly and cheaply as the Liberty ships which were produced in the U.S.A. during the war and which, undoubtedly, made a great contribution to the battle of the Atlantic. He and Mr. Hughes sold their idea to the U.S. Government and work was begun on the first, which was to be made of wood with a view to conserving vital strategic materials. After the war ended this giant was credited with making one short hop with Mr. Hughes at the controls, and thereafter it appeared that the final development of the machine was shelved for lack of funds. To date, it is estimated that some £11 million has been spent on this project, none of which has had to be diverted to the construction of special runways. The Reconstruction Finance Corporation, which has provided the funds for the new development programme, has specified that the Hercules must be in the air by next September: so flying-boat protagonists—especially those who support our own Princess programme—may not have to wait long before additional ammunition becomes available to support their claim that there is a place for the giant flying-boat in our establishment of transport aircraft.

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ONE feels a certain sympathy with the charter companies in this country who, if the current negotiations for an increase in salary of all Corporation pilots are successful, will likewise be faced with a serious increase in operating costs.

Compelled by law to offer conditions of service not less attractive than those of the Corporations—and, incidentally, also compelled by law to have nothing like the same opportunities for planning and stabilization in their personnel requirements—the charter companies are viewing the future with some concern. True, they can pass any salary rises on to their customers in the shape of higher rates; but their chief bugbear is first to find the customers—and higher rates will inevitably mean a harder search.

At the moment there are signs that the Government is turning a kindlier eye on these concerns and there are rumours that they are going to be awarded official contracts or, at least, given a fair chance to bid for them in a proper competitive market. If this is the case, one can presume that officialdom will also look kindly on the rates quoted for such flights, especially as regards the clause which calls for an increase if and when the Corporation pilots' claims succeed.

But this may not apply where other charterers are concerned. Of course, all British companies will be in the same boat—or the same aircraft—but a lot of competition in this field comes from abroad and will not be affected by salary alterations on this side of the Channel.

It looks like one more headache for those most patient of all firms in our civil-aviation set-up.

◆ ◆ ◆

THERE are reports that some new attempts are being made in the U.S.A. to develop a cheap and efficient method of fog dispersal for airport runways. As most people are aware, a scheme ("Fido") was introduced during the war and, from all reports, worked pretty well. It operated on the principle of heating the appropriate mass of air with the aid of numerous petrol-burning jets to a temperature above the local dew-point so that the fog dissolved in the immediate vicinity. However, the number of jets required to provide clearance for a 6,000ft runway was colossal—and so was the cost. Because of this, and although two such installations are available for civil aircraft landing in this country, as far as I know there is practically no record of any pilot making use of them.

Now a firm in the U.S.A.—spurred on, no doubt, by the claims of the rain-makers—is carrying out trials to see if fog can be dispersed by seeding the fog-bank with chemicals. Present reports say that tests carried out on cumulus clouds were satisfactory but that on stratus formations they were disappointing. Since cumulus denotes instability in the atmosphere and the most favourable conditions for fog formation require stability it would not seem that much progress has been attained as yet. Also, there is the awkward fact that the ideal situation for fog is one that includes a gentle breeze—about five knots—to provide the necessary mixing of the air. Once the fog has formed there is not the same need for the wind, but it is often present nevertheless.

It would seem, therefore, that a nicely-seeded patch of air—assuming such a thing to be possible—might drift away before any pilot could make use of it, at least in the right place.

CIVIL AVIATION

DISCUSSING FACILITATION

A STATEMENT made by the I.A.T.A. Facilitation Sub-Committee, issued after a meeting at Caracas (Venezuela) last month, expresses the hope that South American governments will in future do much more to eliminate the red tape which now hampers international air traffic in that area. Venezuela is complimented on having shown progress in the simplification of immigration, customs, health and other border controls. Although not a member of I.C.A.O., Uruguay is also stated to be adapting its own regulations to the standards contained in Annex 9 to the I.C.A.O. Convention (i.e., the facilitation annex). Other Latin-American members of I.C.A.O., however, are said to have shown unsatisfactory progress.

There is to be a meeting of I.C.A.O. Facilitation Division at Buenos Aires on November 12th and it is thought that this may provide some impetus for a greater co-operation between the governments of the South American countries.

In other parts of the world, it seems, air traffic is flowing more freely and with less restriction than ever before. At least 14 countries are reported to have formed special facilitation committees to work out methods of reducing formalities and speeding up frontier procedures.

After reviewing the reports of airline representatives from over 100 countries, the I.A.T.A. group concludes that while the "red tape" situation is less open to criticism than that existing five years ago it is still far from ideal. Some individual operators are said to have failed to take full advantage of the benefits offered by Annex 9. In the Latin-American area most of the trouble seems to be due to unnecessary requirements for consular visas on aircraft manifests, demands for documentation not needed elsewhere, and arbitrary and unreasonable methods of levying fines. Despite I.C.A.O. recommendations to the contrary, it is still the custom in some places, the report states, to require that manifests shall be stamped by consular officers, who are often located at some distance from the airports. Although a number of requirements have already been listed as unnecessary in the I.C.A.O. Annex, some countries still appear to demand their continuance. These documents include police certificates, health forms other than those drafted by the World Health Organization, consular invoices and certificates of origin.

The American and Canadian deportation regulations, which saddle the airlines with the responsibility for returning unwanted aliens to their countries of origin, were singled out as special targets for the I.A.T.A. campaign in the coming year. Although airlines are held responsible for making certain that their passengers possess proper documentation for immediate entry into a country, existing rules also make them responsible for the return of passengers prohibited from landing for reasons beyond the airlines' control—a practice which seems particularly unreasonable. These demands are stated to have had their origin in practices introduced half a century ago to make certain that steamship companies who actively encouraged mass immigration maintained satisfactory screening processes of their own. I.A.T.A.'s report commends the airport managements at Amsterdam, Copenhagen, London, Paris and Zurich for their decisions to establish special direct transit areas for international passengers changing aircraft *en route* to points in other countries, thus eliminating clearance formalities, and consequently reducing delay and saving money.

To encourage more functional planning of future airport terminal layouts, the sub-committee has also drafted a number of suggestions on the most desirable ways of channelling passengers and cargo which have to undergo clearance formalities. It also considered proposals for a standardized visa form to facilitate checking in spite of differences in language. This matter is to receive further consideration at the forthcoming I.C.A.O. meeting. Also on the agenda at this session will be the question of inter-government agreements to exempt from customs and taxation airline ground equipment and spare parts temporarily held at their airports for use in connection with international routes.

AUSTRALIAN OCCASION: Pulling the Australian flag from the door of Q.E.A.'s new booking office in London is the acting High Commissioner, Mr. E. McCarthy, who, assisted by Sir Miles Thomas, performed the official opening ceremony on August 1st.

K.L.M. APPOINTMENT: Mr. Frits Besançon, head of the Dutch airline's production directorate, was last month designated a new vice-president of the company.

CHARTER AIRCRAFT SHORTAGE

THE scarcity of charter aircraft in this country still continues to be acute and, according to brokers' reports, the position is making itself felt in all parts of the charter market. Most of the heavy British machines are now engaged on Government contracts and the light aircraft are still mainly occupied with tourist fixtures made in the early part of the year. Many fixtures are now having to be diverted to foreign operators who are themselves having difficulty in coping with any extra work.

The suggestion has been made by a number of brokers that the situation might be alleviated if all of the government and commercial requirements could be handled from one centralized pool. It is thought that in this way both efficiency and economy would be improved. The scheduled airlines in particular have been hard hit by the present space shortage. Hitherto British and foreign companies have been chartering a limited number of machines to keep pace with the freight being offered. This is no longer possible, and there are now serious backlogs of freight to nearly all destinations in the Eastern hemisphere. For freight space to Africa, the Middle East and Australia, shipments have to wait for about 14 days, while to the Far East there is an indefinite delay.

In some quarters it is felt that a number of the aircraft now working on Government contracts could help to shift these backlogs, even if they are not operated directly in conjunction with the charter market. It is known, for example, that certain flights have travelled empty as far as the Middle East merely because of the absence of machinery to provide these aircraft with loads.

CIVIL AVIATION . . .

COMPACT CONDITIONER. The Godfrey air-conditioning trolley, here seen serving a Hermes IV, is now standardized by B.O.A.C.

The Persian crisis is also said to have caused a reduction in services. It has led to a serious shortage of aviation spirit in India and similar effects are likely to be felt in Pakistan very soon. The shortage will affect aircraft bound for Australia and the Far East. Stocks of petrol are now so low that many of the companies operating these routes have already had to restrict their flights. The situation is regarded as temporary, as normal services should be resumed as soon as the stocks have been replenished from other sources. If the fuel shortage in India continues for much longer, however, it is thought that scheduled services to the Far East may break down completely. This is regarded as yet another reason why the British government should take steps to establish a close liaison between itself and the air transport operators so that everyone may derive the best possible advantages from the space and the fuel supplies which are available.

In Europe, also, there are further troubles. The Russian refusal to grant transit visas for West Berlin manufacturers has led to an accumulation of goods worth nearly six million pounds. In order to cope with this situation a second Berlin airlift has been started on a minor scale. Operating four flights daily from Tempelhof to Hamburg, aircraft of P.A.A., Air France and B.E.A. are together carrying a total of 30 tons a day. To augment this unofficial airlift, a Tudor aircraft operated by Fairflight has also been positioned at Tempelhof. Berlin firms which said they were unable to pay the extra charges for air freight have been told that the difference in transport costs will be defrayed by arrangement between the Berlin municipality and the Allied High Commission. Although, to provide maximum space for freight, seats have been removed from passenger aircraft flying to Berlin, there is apparently no intention at the moment of using any Service machines for this purpose.

HERON ON CHANNEL ISLES SERVICE

BRITISH European Airways were due to start operating, last week-end, the prototype D.H. Heron on services from London Airport to the Channel Islands for a period of five weeks. The experiment is designed to give the manufacturers operating experience with the Heron and also to provide additional capacity for the Corporation at the peak traffic period. The aircraft is being used only at week-ends and all maintenance is being carried out by the manufacturers. A Heron flight to the Scilly Isles, from the co-pilot's viewpoint, was described in *Flight* last week.

U.K. AIRFIELD ACTIVITY

MORE than 213,000 passengers were handled at the United Kingdom airfields during May. This total was nearly 27,000 more than in the corresponding month of last year. Air-transport movements during the month amounted to 15,527, as compared with 17,341 in May 1950. This decrease of 10.5 per cent is mainly due to a reduction in the number of scheduled flights made by B.E.A. and its associates.

The number of movements on international routes rose by about 800 as compared with May 1950. Detailed figures for all reporting airfields are given in the adjacent table.

U.K. AIR TRAFFIC IN MAY

Airfields		Aircraft Movements			Passengers Handled (Terminal and Transit)	Freight (Short Tons)
		Total	Air Transport	Other Flights		
London		4,278	3,023	1,255	71,463	1,324.3
Northolt		4,820	3,860	960	66,472	680.1
Blackbushe		3,290	125	3,165	1,941	134.8
Bovingdon		1,535	52	1,483	692	74.5
Croydon...		1,794	433	1,361	835	117.5
Gatwick		312	31	281	145	—
Stansted		696	4	692	24	—
London Area Totals ...	1951	16,725	7,528	9,197	141,572	2,331.2
	1950	14,931	7,335	7,596	115,983	1,923.2
Provincial						
Aberdeen (Dyce)		1,430	207	1,223	1,369	12.3
Belfast (Nutts Corner) ...		820	730	90	9,856	163.2
Benbecula		120	108	12	665	1.7
Birmingham (Elmdon) ...		1,039	310	729	2,917	28.1
Blackpool (Squires Gate) ...		1,942	133	1,809	504	—
Bristol (Luisgate Bostom) ...		4	—	4	—	—
Bristol (Whitchurch) ...		1,462	98	1,364	627	13.3
Cardiff		4,292	143	4,149	405	—
Edinburgh (Turnhouse) ...		1,824	130	1,694	1,227	4.0
Exeter		862	12	850	22	—
Glasgow (Renfrew)		1,940	880	1,060	10,646	46.8
Hurn		478	25	453	63	—
Inverness (Dalcross)		126	123	3	515	1.2
Islay (Port Ellen)		124	112	12	407	3.9
Isle of Man (Ronaldsway) ...		620	540	80	5,229	24.4
Kintyre (Machrihanish) ...		168	124	44	449	3.6
Kirkwall		302	275	27	1,617	8.8
Land's End (St. Just)		422	377	45	1,800	2.4
Leeds (Yeadon)...		639	28	611	61	—
Liverpool (Speke)		2,166	483	1,683	5,396	71.0
Lympne		1,071	447	624	1,831	838.0
Manchester (Ringway)... ...		2,643	940	1,703	9,011	319.7
Nottingham (Tollerton) ...		200	9	191	75	—
Prestwick		994	555	439	9,375	46.1
Shoreham		835	7	828	13	—
Scilly Isles (St. Marys)... ...		427	382	45	1,788	2.5
Southampton (Eastleigh) ...		1,216	238	978	2,908	2.6
Southampton Water		6	6	—	123	—
Southend (Rochford)		2,511	96	2,415	464	17.8
Stornoway		102	71	31	674	5.5
Sumburgh		77	62	15	582	4.4
Tiree		96	84	12	143	1.1
Weston-super-Mare		184	44	140	95	—
Wick		232	220	12	583	0.9
Alderney		—	289	—	1,161	29.3
Guernsey		—	1,200	—	7,418	68.4
Jersey		—	1,548	—	13,022	53.0
Channel Islands Totals... ...		—	3,037	—	21,601	150.7
All reporting airfields	1951	48,099	15,527	32,572	213,012	3,954.3
	1950	47,064	17,341	29,723	186,152	2,755.3

BREVITIES

TRANS-CANADA Airlines are known to be considering the possibility of ordering either DC-6Bs or Super Constellations in the near future.

* * *

The first of the new Martin 4-0-4s made its initial flight on July 27th; it was one of the 41 machines destined for T.W.A. A further 60 have been ordered by Eastern Air Lines and two more will go to the U.S. Coast Guard.

* * *

The last of the six Saab Scandias ordered by the Brazilian airline, V.A.S.P., was flown from Linköping to Rio de Janeiro; it will be put into service on the Rio-Sao Paulo service. Six more of these Swedish-built twin-engined medium airliners are now being used by S.A.S.

* * *

W. S. Shackleton, Ltd., have sold the three remaining Doves and a large quantity of engines and spares which were previously owned by the East African Airways Corporation. One machine is going to the Middle East; two have gone to Lae, New Guinea.

In France, certification trials are still going ahead with two light prototypes, the Marbore-powered Fouga Cyclope II and the Max Holste 152. The latter machine, incidentally, recently climbed to 17,060ft in 30 min. Lack of oxygen, however, obliged the pilot to discontinue the ascent when his rate of climb was still 320ft/min.

* * *

Mr. K. G. Bakhle, B.Sc., M.I.E., M.Inst.T., has now taken up his appointment as managing director of Air India and Air India International, Ltd. Mr. Bakhle retired in April from the position of Chief Commissioner of Indian Railways after 25 years of service.

* * *

At a cost of £20,000 each, three new control towers of standard design are to be built on the Australian airports of Essendon (Melbourne), Mascot (Sydney) and Eagle Farm (Brisbane). Special attention will be given to the siting of the new towers, which will be located near the thresholds of the instrument runways so that the interval for safety between landings can be reduced to a minimum.

Western Air Lines are to modify their ten Convair 240s in order to give them the permissible gross weight of 41,790 lb. The modifications include an increase in power-output, and will also result in better cruising speeds.

* * *

Qantas Empire Airways have purchased two Plymouth flying boats from B.O.A.C. for use on their routes to Lord Howe Island, Noumea, Fiji and the New Hebrides. Both machines have arrived in Sydney and are to be put into service immediately.

* * *

A 20 per cent increase in international traffic during the first five months of this year is indicated by transactions handled by the I.A.T.A. Clearing House at London. The total turnover for this period amounted to $61,919,000, as compared with $51,757,000 in the corresponding period of 1950.

The first aircraft of its type to be used in Iceland, an Auster Mk 5, has been completed for Larus Oskarsson and Company. It will be equipped for aerial photography, air ambulance and general transport duties.

* * *

Garuda Indonesian Airways have opened a direct service between Djakarta and Manila; the flight is completed in eight hours with one stop at Labuan, Borneo. The possibilities of a regular service between Indonesia and Thailand—to be operated jointly by Siamese Airways and Garuda—are also being discussed.

* * *

The M.C.A. announces that Mr. S. S. Dickinson has been appointed to succeed G/C. C. Clarkson, A.F.C., as Civil Air Attaché in Washington. Mr. Dickinson joined the Ministry of Aircraft Production in 1941, finally becoming an Assistant Secretary in the M.C.A. in 1947; he has also been closely connected with development work at the London Airport.

CLUB AND GLIDING NEWS

IT now seems that the flying-time claim made by the Wiltshire Flying Club (see *Flight*, July 13th) has been bettered by the Herts and Essex Aero Club, which operates from Broxbourne. Using a fleet of 13 machines, this club has succeeded in logging the astonishing total of 1,571 hr between January and July, thus beating the W.F.C.'s record of 1,151 hr by a substantial margin. We understand that the Very Pistol, mentioned in the challenge, is to be presented at the earliest possible opportunity!

Last month no fewer than 11 H. and E. pupils embarked upon their first solos, and the C.F.I., Mr. P. Ayles, has high hopes of beating the record this month. Since it re-opened after the war the Club has logged a total of about 15,000 hours' flying. Out of the 300 members, over 200 take an active part in flying. The club has also taken under its wing a number of A.T.C. cadets and to date 18 Private Pilots' Licences have been obtained; three more cadets are expected to finish their courses in the near future.

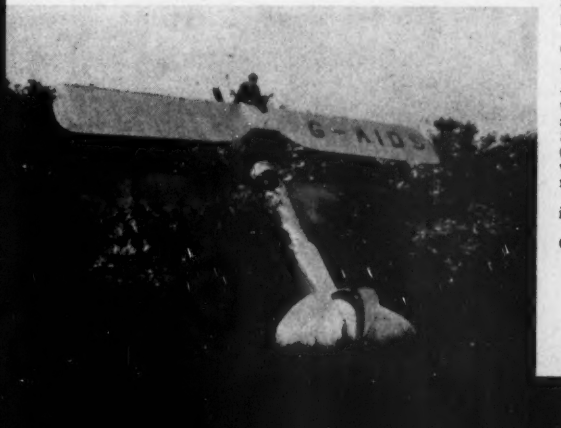
Incidentally, the secretary, Mr. E. Darlow, intimates that a breakfast patrol is to be organized shortly; the actual date will depend largely on the bacon-yielding capacity of a handsome pig which is now being fattened for the occasion.

From Broxbourne, too, comes news (see photograph) of a tree-climbing Tiger Moth. Its achievement has prompted the following poetic gem (with apologies to the author of *Trees*) from Mr. H. A. Smith, one of the club's engineers :—

To think that I should ever see
A Tiger Moth up in a tree:
A tree whose countenance is pressed
Against the Tiger's oily chest,
A tree whose leafy arms embrace
This thing which came to her through space.

A tree who may in summer wear
A battered airscrew in her hair,
And on her bosom shyly borne,
A set of mainplanes, somewhat torn,
While, lying close beside her heart,
Is tightly pressed an undercart.

A tree who held with tender care
This navigator of the air,
Until some men with tools and crane
Her burden carried home again.
Planes are repaired by fools like me,
But how can we repair the tree?



BIRD-NESTING: Having deposited his machine neatly in the trees bordering Broxbourne airfield (see above), it appears that the pilot need only sit back and wait for his registration lettering to bring help.

ULTRA-LÉGER: Built by Pierre Morin of the Aéro Club Canton de Sceaux, this new French ultra-light flew for the first time at Toussus on July 4th. The engine is a 27 h.p. Ava two-stroke.

OPERATING a small but steadily increasing fleet, the Elstree Flying Club is also having a busy season, 250 hr having been logged since May. Some 50 pupils are now undergoing instruction, ten of whom have already reached the solo stage. Incidentally, both the C.F.I., Mr. David Cotter, and his assistant flying instructress, Mrs. "Peggy" Grace, were due to compete in the *Daily Express* Race at Shoreham last Monday.

One particularly attractive aspect of flying at Elstree is that instructional rates have now been reduced to as little as 46s. 6d. per hour on Taylorcraft and Austers. This should be a real encouragement to would-be pilots and, as far as we know, is the lowest instructional rate at present being offered in this country.

WITH a total of over 1,000 hr since the beginning of this year, the London Aeroplane Club at Panshanger is enjoying its most active season on record. Twelve aircraft are now in service, including two Moth Minors, one of which was entered for the *Daily Express* Race.

It is unusual to find a club in which there is such a high proportion of active flying members—the actual figure is over 200 out of a total of 230. The fairer sex is also quite well represented, there being six women pilots in all, two of whom have now obtained their Private Pilots tickets; the remaining four are still logging the requisite number of hours to qualify.

It is interesting to note that it was in one of the London Aeroplane Club's hangars that the D.H. 60, G-EBLV, was practically rebuilt, before being placed on show at the Hendon display. This machine has now been awarded a normal C. of A. and takes pride of place as the first entry in the British Register of Civil Aircraft.

At Panshanger, instructional flying is obtainable at £3 per hour on Tiger Moths, and £3 3s. on Chipmunks.

HAVING (as recorded above) lost the first round of its friendly battle with the Herts and Essex Aero Club for the highest total of flying hours recorded this year, the Wiltshire Flying Club at Thruxton is now making an all-out effort to make up the leeway. Since no fewer than 18 pupils will be in residence by August 8th (with the possibility of an additional four who are now on their way from overseas), it seems possible that Thruxton may yet re-claim its lost laurels.

Another Tiger Moth has been added to the fleet, which now includes five Auster Autocrats and four Tiger Moths.

The club now announces definitely that the Thruxton Race and Garden Party, which was arranged for August 18th, is cancelled.

After receiving the Royal Salute, the Princess, accompanied by the Commandant of the College, inspects the Parade.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

F/Cdt. U/Off. H. A. Merriman receives the Sword of Honour. He was also, unusually, awarded the King's Medal.

PRINCESS ELIZABETH at CRANWELL

MAKING her first visit to the Royal Air Force College, Her Royal Highness Princess Elizabeth, on Aug. 1st reviewed the graduation parade of No. 53 Entry, and presented the principal awards. It was a sparkling day, with an all-pervading feeling of *bonhomie* and friendliness that was almost tangible.

The Princess travelled up by train during the night, and arrived at the College by car, accompanied by Marshal of the Royal Air Force Sir John Slessor, and the Lord Lieutenant of Lincolnshire, Lord Willoughby de Eresby. As Her Royal Highness was escorted to the saluting base, a fanfare was sounded and, simultaneously, her personal standard was broken from the staff over the main entry to the College. The Cadet Wing parade of four squadrons drawn up in three ranks facing the saluting base received the Princess with a Royal Salute, after which Her Royal Highness, accompanied by the Commandant, A. Cdre. L. F. Sinclair, G.C., C.B., C.B.E., D.S.O., and the cadet parade commander, and preceded by the Commandant's orderlies, inspected the cadets.

After the inspection, the Princess returned to the dais, and the parade, with the King's Colour in the centre, marched before the saluting base first in slow time and then in quick time, thereafter reforming in three ranks preparatory to advancing in review order. Her Royal Highness then presented the Sword of Honour and the King's Medal to F/Cdt. U/Off. H. A. Merriman, and the Medal of Honour to F/Cdt. U/Off. B. A. Spry.

In her address to the parade, Princess Elizabeth said :—

"It has given me great pleasure to come here today to take the Salute at this Passing-out Parade, and I congratulate you on your smartness and steadiness.

"In many ways, the great Service to which you have given your loyalty is a Service of youth because it calls for quickness of mind and body, and that fearless dash and spirit which is one of the finest qualities of youth. But it calls also for another quality which is, I believe, of great importance, and that is a sense of responsibility which is often associated with maturity.

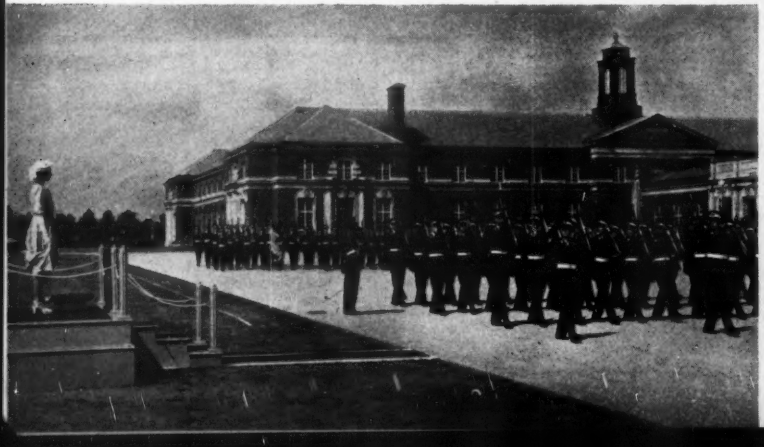
"The Royal Air Force must always be instantly in the forefront for the defence of our country if we are ever again called upon to take up arms in the cause of liberty. This lays upon you the responsibility of constant preparedness, and the need to be the master at all times of the science and art of flying.

"Responsibility lies upon you also in the days of peace, for whenever you take to the air in the machines of almost elemental power that modern science has given you, you take your own lives and the lives of others in your hands.

"But if this responsibility is heavy, it is not a dead weight which will bear you down. It is rather an honourable charge which, if you bear it, will strengthen and uphold you as men. I think you are lucky to have it put upon you so early in life, for it is, indeed, the badge of manhood.

"You all have my good wishes for your future in the Royal Air Force, and I pray that fortune will smile on your wings wherever they may bear you."

The Colour Party, followed by the senior entry, then marched in slow time off the parade ground and into the main entrance of the College, after which the Cadet Wing was marched off east and west in paired squadrons. After lunch, the Princess came out on to the parade ground where, standing informally in the centre of a group of cadets, she watched a brief display of formation aerobatics by three Vampires of No. 72 Squadron.



Princess Elizabeth takes the salute of the Cadet Wing marching past, by squadrons, in slow time to the tune "The Road to the Isles."

Halton Graduation

A MARCH-PAST by the 60th to 67th Entries at the No. 1 School of Technical Training, Halton, on July 31st opened the passing-out ceremony of the 60th Entry of Aircraft Apprentices. The reviewing officer, Mr. Arthur Henderson, Secretary of State for Air, was accompanied by Air Marshal Sir John Whitworth Jones, A.O.C.-in-C., Technical Training Command; A. V-M. R. O. Jones, A.O.C. 24 Group; A. Cdre. J. G. Elton, Commandant, R.A.F. Halton; G/C. D. O. Finlay, Senior Training Officer, No. 1 S. of T.T.; and W/C. L. Rose, O.C. No. 2 Apprentice Wing. The parade, under the command of F/S. App. J. L. Spatcher, 60th Entry,

Princess Elizabeth has a look into the cockpit of a Canberra visiting Cranwell from Manby.

"Flight" photographs

Halton prizewinners: (Above) Sgt. App. D. Allison, F/S. App. J. L. Spatcher, Cpl. App. J. A. Cliff, and Sgt. App. E. Davies. (Right) The twin brothers, Cpl. App. J. McLeod (General Duties) and L.A. App. P. McLeod (Secretarial), who were both awarded cadetships.

was supported by the apprentices' own silver, pipe and fife bands.

The Commandant, A. Cdre. J. G. Elton, in his opening address, welcomed parents and relatives and outlined the objects and achievements of the school since it was founded some 31 years ago by Viscount Trenchard. He mentioned the difficult problem of providing realism in training and quoted, as an example of methods now adopted, an instance of apprentices flying on a practice sortie in which they released the bombs they had themselves fused and loaded on to the aircraft.

In his address, Mr. Henderson made reference to Russian peace offers and to the danger of complacency.

Cadetships have been awarded to: General Duties: Sgt. App. D. Allison; Sgt. App. J. E. Fitzpatrick; Cpl. App. J. McLeod; Technical Branch: Sgt. App. J. F. Claxton; Secretarial Branch: L.A.A. P. McLeod. Cpl. J. McLeod and L.A.A. P. McLeod, incidentally, are twin brothers.

Among the prize-winners, Sgt. App. D. Allison took no fewer than four awards: he was highest in all subjects, in educational subjects, and in general Service efficiency; he also received the Elliot Memorial Prize. His brother, Duncan Allison, was a prize-winner of the 58th Entry.

F/S. App. J. L. Spatcher received three prizes—an award for the highest average in practical fitting over the three-year course; the Monsignor Beauchamp Memorial Prize; and the Crebbin-Robinson Cup.

The best tradesmen in the Trade Test examinations were: *Airframe Fitter*, Sgt. App. E. Davies; *Armament Fitter*, Sgt. App. D Allison; *Electrical Fitter (Air)*, Cpl. App. P. W. Pearce; *Electrical Fitter (Ground)*, Air App. J. R. Reynolds; *Engine Fitter*, F/S App. J. L. Spatcher; *Instrument Fitter (Nav.)*, Cpl. App. J. McLeod; *Instrument Fitter (Gen.)*, Air App. J. W. Thomason.

The 60th Entry arrived at Halton on September 27th, 1948, and will proceed to selected R.A.F. units on August 23rd as fully-trained junior technicians.

King's Colours and Standards

SOME confusion appears to exist regarding the differences between the King's Colours and the King's Standards.

In the Army the Colours are considered as symbolizing the spirit of the regiment, and on them the battle honours and badges awarded for deeds of gallantry are displayed. The R.A.F. is maintaining the same tradition, and the King's Colour for the R.A.F., presented last May, is a symbol representing all the Air Forces at home. R.A.F. College, Cranwell, received a Colour in 1948 and another is to be presented to No. 1 School of Technical Training, Halton, at a later date.

The Squadron Standards follow the same tradition and are being awarded to all the units meeting certain qualifications. They will be given after 25 years' Air Force service or as a mark of appreciation by the King for specially outstanding operations.

The Standard, therefore, in addition to acting as a symbol, is also an award to be gained by specific service, acts of gallantry and devotion to duty as approved by His Majesty. These acts of heroism are likely to be commemorated upon the Standard in the same manner as battle honours.

A Standard, as such, appears to have originated in the days of pike companies, when it was displayed on the pike staff. Colours were last carried in battle at Laing's Nek, South Africa, in 1881.

R.C.A.F. Appointments

THE rapid expansion of the R.C.A.F. has resulted in three major changes among senior personnel. A. V-M. F. R. Miller, C.B.E., formerly head of the Operations and Training Division at R.C.A.F. headquarters, is to become Vice Chief of the Air Staff. In his new post he will head the combined divisions of Air Plans and Operations and Training. A.V-M. C. R. Dunlap, C.B.E., who recently took over the newly-formed Air Defence Command is the new commandant of the National Defence College. His place at A.D.C. will be taken by A.V-M. A. L. James, C.B.E., head of the Air Plans Division.

A. Cdre. F. G. Wait, C.B.E., who will be promoted to Air Vice Marshal on taking over the position, is to be head of the Personnel Division and his deputy will be A. Cdre. L. E. Wray, O.B.E., A.F.C., now commandant of the R.C.A.F. Staff College in Toronto.

Mr. Arthur Henderson, with A. Cdre. J. G. Elton, Commandant, R.A.F. Halton, inspecting apprentices of the 60th Entry at last week's passing-out parade.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Rearward-facing Seats

MR. STANHORE has hit the nail smack on the head in his letter (*Flight*, July 27th). R.A.F. Transport Command aircraft are now equipped with rearward-facing seats and, in the only major crashes which Transport aircraft have suffered since the seat arrangements were made sensible, none of the passengers has been seriously hurt. This is *really* important.

Obviously, the airline operators have to think in commercial terms, and are constantly preoccupied with payload, profit and loss. But don't for heaven's sake let them gull people by saying that passengers don't want r-f. seats : they do—I do, and everyone else I know who flies wants them, too.

It is certainly costly in weight to have seats facing backwards, because of the greater strength required. All right. Say a pair of r-f. seats + anchorage + greater floor strength totals an increase of 10 lb in weight per pair of seats; cut down the free baggage allowance of each passenger by 5 lb and there you are.

London, S.W.1. JOHN HOWARD.

Flying Films—a Suggestion

I HAVE followed with interest the news items and correspondence on the film *Hawks in the Sun* [Now to revert, we understand, to the original title *Angels One Five*—ED.] and the trouble there has been to secure Hawker Hurricanes for this picture.

It would be a good thing if some far-sighted film company were to make a film of, say, the raid on the Mohne dam, while we still have aircraft of the type that took part in the raid, i.e., Lancasters. Thus authenticity would be assured, instead of an attempt having to be made in ten years' time with the use of mock-ups.

Beckenham, S.E.20. H. C. GORE.

The Case for the Flying-boat

WE feel that it is time the cause of the flying-boat was publicly aired once more. Past arguments against them have been unconvincing and we are firmly of the opinion that it is absurd to develop long transoceanic hauls using land-based aircraft.

Modern landplanes need not only land to alight on, but specially prepared land, viz., expensive concrete runways. Over 70 per cent of the earth's surface is the natural element for the seaplane, while the landplane can use only an infinitesimal portion of the remaining 30 per cent. or so.

A flying-boat stands a far better chance when landing out of its element than does a land aircraft. One of the writers has seen a practically undamaged Sunderland which had been deliberately landed on solid ground, whereas there are numerous examples of landplanes foundering at sea without trace. A "ditched" flying-boat crew can survive longer in any conditions than can those of a landplane, and necessary repairs and adjustments can be effected. Should any remedial action be beyond the capabilities of the crew on the spot, more time is available to initiate rescue arrangements both on the spot and from the nearest base. It will be recalled that the *Bermuda Sky Queen* did not founder, but was eventually sunk by gunfire.

The two writers of this letter, far from having any financial interest in seaplanes, depend for their civilian livelihood principally on land aircraft and for that reason sign themselves

Bristol. TECH (E.).

The New Weapon

YOUR readers will be familiar with the tremendous potential and (I'm afraid) tragic importance of the long-distance rocket for the future, especially when one is reminded that in Russia they are now seven years ahead of the 1944 V.2. I believe that in the stress of these times our everyday preoccupations and responsibilities render all of us liable to a certain inertia of the mind when asked to face the possibilities of the future as probabilities of the present. Therein, more than anything perhaps, lies the tragedy of our present position.

Had we in the past considered the possibilities of the future in a more statesmanlike manner, the "Giant Colossus bestriding Europe and Asia" need not have grown so big or so menacing. This inertia of mind in the past is largely responsible for the present mass effort in arms production between the Russian east and the American west. Will this result in world conflict? I have never known or read of an armaments race on this scale resulting in anything else.

In such event, is it not reasonable to imagine the possibility of this country's fate being in grave danger of resembling that of South Korea on a greatly magnified scale?

I believe that *the* principal weapon in such a conflict will be the long-distance rocket. It is this particular danger and the element which is its medium that one hopes to see more widely recognised and appreciated.

Folkestone. HARRY EDMONDS.

[The writer is the author of a recently published novel, *The Rockets—Operation Manhattan* (Macdonald, 9s. 6d.)—ED.]

WANTED, THREE VOLUNTEERS—YOU, YOU AND YOU

RECENTLY we had an opportunity to learn something of the early impressions formed by the ex-war-time flying instructors who had been recalled from the Volunteer Reserve for eighteen months' regular service in the R.A.F. There are those among them who feel strongly about the whole recall business, and others who are resigned, but all seem anxious to do as much useful work as possible in the time. To anyone who asks, "But are these men not volunteers?", the answer is an old one—it depends what you mean by volunteers.

One R.A.F. station to which the men have been posted for their first month is described as agreeable enough, with living conditions good. The day's work starts with briefing at 0800 hr or earlier, and continues until 1700 hr. One of the jobs of the unit is to put three-month-course V.R.s through their six weeks' refresher on Harvards. Eighteen-monthers regard these three-monthers as being well off. It is said that their civilian jobs do not suffer much, that they are paid on the nail, that they receive a £50 bounty as well as their annual V.R. gratuity of £35, and, moreover, that they are able to get on with the job—must get on with it, in fact, to get through the Harvard, Spitfire and jet syllabus in twelve weeks.

In contrast, many of the eighteen-monthers seem to be worried about their civilian jobs, are taking a long time to "get operative" in the R.A.F., and have been given no gen regarding a gratuity (or should it be called compensation?). They are finding pay slow in coming through, and this leads to complications at home.

Uniform is a problem, too. After 1900 hr officers usually may not enter the mess in their battledress, but for the V.R.s this is their "Number One," so they must wear either civilian suits or a war-time uniform that has managed to survive gardening, moth, corrosion and thieves. In the barrack room it is pointed out that this clothing is now provided and maintained at the V.R. officer's own expense. There is the other side of the picture, of course, namely, that no uniform sometimes means no parades.

A small cloud hanging over eighteen-month V.R. heads is the possibility of a three-week leadership course. The feeling is that, if a man has to give up his civilian job to instruct in the air, he should be given every chance to get on with it and not have to spend time "camping out, drilling and marching about." It could be that the expansion of instructional facilities has not kept pace with the intake of types. If so, a leadership course is probably as good a pastime as any other. Anyone who has spent long in uniform will remember the formula.

It seems that, generally speaking, all the "regular V.R.s" are prepared to make the best of the circumstances in which they find themselves. There is a feeling, however, that they may have to form a union to look after their interests, unless they are to suffer from the difficulties of being in-betweens. They claim that nobody loves them, either the pros or the amateurs.

FORTHCOMING EVENTS

Aug.	11.	Leicestershire Aero Club: Rally and Display, Leicester East Airfield.
Aug.	12-18.	International Air Circuit of Switzerland.
Aug.	18-19.	U.S. National Air Races, Detroit.
Aug.	19.	Yorkshire Aeroplane Club: "At Home" (sponsored by A.B.A.C.).
Aug.	25.	Exeter Aero Club: Display.
Aug.	25-26.	Skegness Airport: Aerial Week-end.
Aug.	25-26.	International Air Circuit of the Dolomites, Italy.
Sept.	1.	R. N. Air Stations Gosport and Lee-on-Solent: Air Display.
Sept.	2.	A.B.A.C. Summer Convention.
Sept.	3-7.	R.Ae.S. and I.Ae.S.: Third Anglo-American Aeronautical Conference, Brighton.
Sept.	3-8.	International Congress of Astronautics.
Sept.	9.	Society of Model Aeronautical Engineers: Model Flying Festival, Sherburn-in-Elmet.
Sept.	10.	R.Ae.S: 39th Wilbur Wright Memorial Lecture—"The Well-tempered Aircraft," by A. E. Raymond.
Sept.	10-16.	Battle of Britain Week.
Sept.	11-16.	S.B.A.C.: Flying Display and Exhibition, Farnborough.
Sept.	15-16.	International Rally, Parme, Biarritz, France.
Sept.	25.	Milan International Grand Prix.
Oct.	31.	R.Ae.C.: Jubilee Ball.

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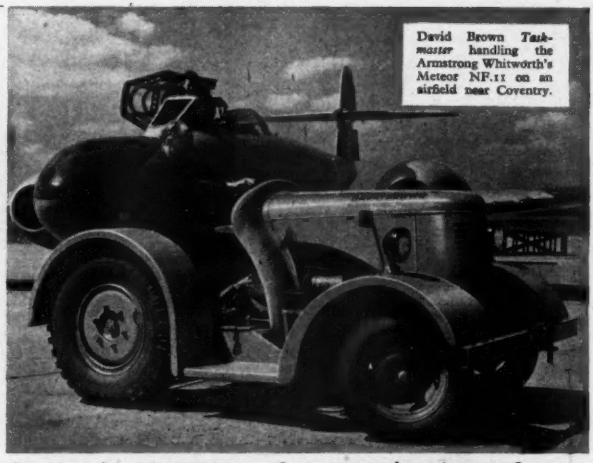

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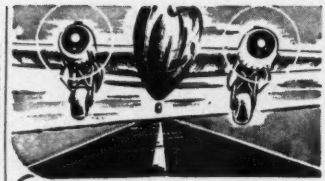

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DESIGNER for hydraulic, pneumatic, mechanical accessories such as pumps, servo mechanisms, actuators, etc. A senior position with high salary and pension scheme awaits the right applicant, who should be of degree standard with several years' suitable experience, preferably in aircraft engineering.

SENIOR design draughtsman with university degree and/or Ordinary National Certificate or Higher National Certificate and experience in one or more of the following: servo mechanisms, hydraulics, pneumatics, optics and materials as related to aircraft or armament work. The position is progressive and permanent to a suitable applicant.

DRAUGHTSMEN with experience in mechanical, hydraulic or pneumatic accessories. Ordinary National Certificate desirable but not essential if otherwise suitably experienced.

DRAUGHTSMEN with several years' instrument design experience.

STRESSMAN of degree standard with at least four years' experience in stressing of aircraft structures and with knowledge of materials. Permanent senior position with good salary and pension plan is offered to suitable applicant.

HONOURS graduates and graduates with knowledge of supersonic aerodynamics and/or servo mechanism approach to stability.

WRITE full details, qualifications, experience, age, salary sought, to Box AC.64414, Samson Clarke, 57-61, Mortimer Street, London, W.1. [6698

LICENSED aircraft radio maintenance engineer required immediately. Please write, Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0611

NORMALAIR, Ltd., Yeovil, invite applications from the following for work in connection with aircraft air conditioning, pressurising, and high altitude breathing equipment:

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DRAUGHTSMEN.

TECHNICAL ASSISTANTS.

TECHNICAL CLERKS.

TECHNICAL WRITERS.

TECHNICAL ILLUSTRATORS.

STRESSMEN.

APPLICATIONS to the Personnel Officer, Normalair, Ltd., Yeovil, Somerset, must state age, experience, qualifications and salary required. Where convenient selected applicants will be interviewed in towns near their address. [6743

"A" AND "C" Dakota (minimum) and multi-engine licensed aircraft engineers and experienced fitters/riggers required.—Apply: Westminster Airways Servicing, Ltd., Blackbushe Airport, nr. Camberley, Surrey. [6732

AIRCRAFT stressmen required.—Write, stating experience and qualifications, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [6692

AIRFRAME and engine fitters urgently required. Experience on Mosquito aircraft and Merlin engines an advantage.—Apply in person, or write: Airwork, Ltd., R.N.A.S., Brawdy, Pembs, S. Wales. [6721

ESTIMATORS and rate-fixers required, accustomed to aircraft work, for the south-west area.—Write, giving full particulars, to Box H6935, A.K. Advertising, 212a, Shaftesbury Avenue, W.C.2. [6713

SITUATIONS VACANT

BROOKLANDS AVIATION, Ltd., have vacancies for airframe and engine fitters, electricians for servicing and repair of R.A.F. aircraft. Good wages and piecework bonus.
APPLY: No. 4 Site, Sywell, Northants. [0308

JIG and tool draughtsman required, fully experienced. —Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0360

JIG and tool draughtsmen required. Previous aircraft experience not essential. Pension and life assurance scheme. Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0754

WANTED, flight engineers for York aircraft. "A" and "C" to cover York aircraft essential.—Apply: Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0810

APPLICATIONS are invited from design draughtsmen and stressmen; also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.
APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, The de Havilland Engine Co., Ltd., Stonegrove, Edgware, Middx. [0676

AERONAUTICAL or mechanical draughtsmen and stressmen required, all grades. Apply, stating age, experience and salary required, to Alan Muntz & Co., Ltd., Aircraft Section, Heston Airport, Hounslow, Middlesex. [0785

SCHEDULE clerks required (male), with experience in compiling M.O.S. spares schedules. Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [0696

BRITISH OVERSEAS AIRWAYS CORPORATION have a vacancy for a draughtsman at London Airport with experience in aircraft and engine design. A.E.S.D. rates. Good pension, sickness and holiday entitlements.—Write to Staff Manager, London Airport, Feltham, Middx. [0733

MECHANICAL, structural or general engineering draughtsman wanted for aircraft work; previous aircraft experience not essential; pension and life assurance scheme.—Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0658

EXPERIENCED airframe fitters required for work on military metal and composite aircraft. Long contracts. Union rates and bonus. Assisted travel. Canteen, etc.—Apply: Airwork, Ltd., Gatwick Airport, Surrey. [0697

TECHNICAL authors and illustrators required. Knowledge of M.O.S. procedure desirable.—Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds. [0909

GLOSTER AIRCRAFT Co., Ltd., have vacancies for fully experienced aircraft structural and electrical draughtsmen. Applications, in writing, stating age, experience and salary required, to Employment Office, G.A.C., Ltd., Hucclecote, Glos. [0910

ENGINEER, minimum A. and C. Dakotas for private flight, His Highness, Bhopal, India. Six months. Salary Rs 1,800 per month (£135), plus provident fund. Free bungalow, transport. Preference engineer pilot's "A" or above. Further details, Box 3226. [0902

REQUIRED immediately, "A" and "C" licensed engineer, some experience approved inspection organisation desirable. Also fitters, airframe and engine, required.—Apply: Air Schools, Ltd., Municipal Aerodrome, Wolverhampton. [0925

SENIOR weight engineers required. Interesting work on new projects. Permanent positions offered to suitable applicants. Apply, stating age, experience, qualifications and salary required, to Chief Designer, Gloster Aircraft Co., Hucclecote, Glos. [0744

TECHNICAL author required for description of aircraft hydraulic equipment for Ministry of Supply and Air Registration Board handbooks; and for technical publicity. Good general education and experience of similar work.—Apply: Personnel Manager, Electro-Hydraulics, Ltd., Warrington, Lancs. [0756

THE AIRWAYS AERO CLUB have a vacancy for an aircraft engineer licensed in categories "A" (Auster series, Miles Hawk) and "C" (Cirrus Minors, Gipsy Majors) to work on a full-time basis at Denham Aerodrome. The rate of pay will be assessed according to qualifications. Applications to Chief Engineer. [0744

STRESS calculating experienced man required by aircraft engineers in Midlands. Must hold Higher National Cert. or equivalent qualifications. Excellent prospects for keen and competent man. State fully details of experience and qualifications, age and salary required to Box 3265. [0745

SENIOR jig and tool draughtsman required with experience in current production methods of aircraft and aircraft accessories manufacture. Pleasant working conditions. Write fully: Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, near Blandford, Dorset. [0749

PRESS tool designers are required by large engineering company in the Southampton area. Applications are invited from men with the necessary tool-room and draughting experience. High salary and good prospects for men who require ability.—Box 6711, A.D. Advertising, 212a, Shaftesbury Avenue, London, W.C.2. [0722

DOWTY EQUIPMENT, Ltd., Aircraft Hydraulic Engineers, Arle Court, Cheltenham, require design draughtsmen, preferably with some knowledge of hydraulic and landing gear components for aircraft. Write: Personnel Manager, giving details of training and experience, and mentioning age and salary range. [0692

TOOL draughtsmen, qualified seniors and juniors required. Varied and interesting projects. Pension scheme. Toolmakers will also be considered for some of the vacancies. Full details to the Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting Ref. P/JM3. [0941

SKILLED aircraft maintenance fitter required with some experience on aircraft engines. Minimum of 8 years' experience in this trade essential; preference given to licence holder, but not essential. Lodging accommodation arrangeable. Write (quoting Ad. 506), stating age and full details of experience, to Personnel Manager, Pest Control, Ltd., Bourn, Cambridge. [0715

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd. Applications are invited from senior and junior draughtsmen, and stressmen, for work on this interesting programme. Write, giving details of experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Luton, Beds. [0595

HANDLEY PAGE, Ltd., have vacancies for senior and junior technical assistants in their mechanical and structural test departments at Cricklewood and Radlett. Qualifications should include a degree or Higher National Certificate. Previous experience is desirable but not essential.—Write, stating age, qualifications and details of experience, to: Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [0736

SITUATIONS VACANT

HANDLEY PAGE, Ltd., require an electrical technician, preferably with H.N.C. (Elect.) and with a knowledge of electronics, for work in connection with the development of aircraft electrical circuits and installations.—Write, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [0759

DRAUGHTSMEN with experience in high-quality light mechanical or hydraulic engineering are required by progressive Midland manufacturing company. Positions with good prospects are available to younger men. Salaries will be in accordance with age, qualifications and experience. State details, together with salary required to Box 3266. [0746

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft. Hobson Works, Fordhouses, Wolverhampton. [0420

THE WESTERN MANUFACTURING ESTATE, Ltd., has a vacancy for a first-class designer-draughtsman with electro-mechanical hydraulic and servo experience. Applicant should be educated to at least Higher National Certificate standard.—Apply: Personnel Department, Western Manufacturing Estate, Ltd., Woodley Aerodrome, Reading, Berks. [0742

APPLICATIONS are invited from senior and intermediate design draughtsmen: experience of aero engine design desirable but not essential. Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0449

DEVELOPMENT engineers and senior draughtsmen required with experience in light hydraulic controls and/or fuel metering equipment; also detailing draughtsmen for this type of work. The factory is situated in the grounds of a country house and the wages and conditions are excellent. Hostel available. Write, Personnel Manager, Dowty Equipment, Ltd., Arle Court, Cheltenham. [0803

BRITISH OVERSEAS AIRWAYS CORPORATION offer opportunities of work on modern air liners to the following tradesmen: electricians, engine and airframe fitters, sheet metal workers and instrument and radio mechanics experienced in the maintenance or overhaul of aircraft and/or components. Rates of pay 2s. 10d. per hour plus 4d. per hour provisional bonus. Attractive proficiency pay up to 3d. per hour; 5-day, 44-hour week. Possible shift work. Good pension, sick pay and holiday facilities.—Write or call, Staff Manager, Hut 29, London Airport, Feltham, Middlesex. [0800

EXECUTIVE engineer required by an internationally famous manufacturer of aircraft radio equipment to act as representative at aeronautical conferences or in negotiations with executives of overseas Government authorities and Air Lines. Candidates must be experienced in the above duties and should possess exceptional knowledge of the application of modern electronic techniques to civil and military aviation. A good radio engineering background is essential, together with some knowledge and experience in the planning of radio communications systems and navigational aids for air routes. A knowledge of French and Spanish would be advantageous. A good salary will be offered to a suitable applicant.—Please apply, giving full details of qualifications and experience and quoting ref. IAJ, to Box 3267. [0747

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HANDLEY PAGE, Ltd., have a vacancy for a technical assistant with a good mechanical engineering background, who will be required to carry out work in connection with thermo-dynamic problems for aircraft air conditioning and thermal de-icing systems. Write, stating age and giving particulars of qualifications and experience, to: Staff Officer, Handley Page, Ltd., Claremont Road, London, N.W.2. [0751

THE GLOSTER AIRCRAFT Co. requires senior and intermediate stressmen to work on designs and projects of advanced interest. Excellent prospects of advancement for sound and energetic men. Apply, in first instance, giving full particulars of technical qualifications, age, experience and salary required, to The Chief Designer, Gloster Aircraft Co., Ltd., Hucclecote, Glos. [0911

BRITISH EUROPEAN AIRWAYS have vacancies for instrument mechanics, radio mechanics, electricians, sheet metal workers, airframe and engine fitters. Hourly rates 2/10 plus 4½d. provisional bonus, plus up to 3d. proficiency pay. Opportunity for good bonus earnings. Pension, insurance and sick pay schemes; two weeks' paid holiday a year; air travel concessions.—Apply: Personnel Officer, B.E.A., Northolt Base, Ruislip, Middlesex. [0741

A VACANCY exists in the electronics section of the research department for an electronics engineer, preferably with a degree in mathematics, for the design of equipment for electronic measurement of physical variables and associated problems. Applications, stating age, qualifications, experience and salary required, should be addressed to the Personnel Officer, Westland Aircraft, Ltd., Yeovil, Somerset. [0691

A HOUSE (married accommodation) is available for an experienced electronics engineer capable of developing anti-vibration means for electronic equipment. Location is special laboratory within 50 miles of London. Starting salary £600-£800 per annum, according to qualifications. Send details of qualifications and experience, mentioning Ref. 850B, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [0451

NORMALAIR, Ltd., invite applications from designers and draughtsmen for work in their London office, in connection with aircraft air-conditioning, pressurising and high altitude breathing equipment. Experience of aircraft equipment and/or delicate instrument work is essential, only first-class qualified men will be considered. Applications, stating age, experience, qualifications, and salary required should, in the first instance, be addressed to the Personnel Officer, Normalair, Ltd., Yeovil, Somerset. [0690

HANDLEY PAGE (READING), Ltd., have vacancies in their design offices for senior and junior draughtsmen with aircraft experience. Also required are stressmen, who should have at least two years' experience and with a degree or Higher National Certificate with endorsements in aeronautical subjects. These positions are progressive and offer excellent opportunities to the right men.—Please send full particulars to the Personnel Office, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [0901

ELECTRO-HYDRAULICS, Ltd. require a chief electrical engineer to be responsible for the design and development of light electrical equipment for aircraft and other purposes. Applicants should have a first or second class honours degree in electrical engineering, or equivalent, and similar practical training, and have had some experience of the control of design and development groups. Knowledge of servo systems and control gear would be an advantage. Apply: Chief Designer, Electro-Hydraulics, Ltd., Warrington. [0725

BRITISH EUROPEAN AIRWAYS have a vacancy in their Project Branch, Head Office, Ruislip, for a technical author to work on maintenance and operating manuals for aircraft and accessories. Experience as a technical author, wide general knowledge of aircraft, systems and construction, several years' experience of aeronautical work and some knowledge of printing methods are essential. Age 25-35. Salary £650-£800.—Applications to Personnel Manager, B.E.A. Keyline House, Ruislip, Middlesex. [0740

THE AIRCRAFT Co. requires the services of a number of aerodynamicists, (a) for design and project work, and (b) for flight test reduction. Opportunity exists for individuals to vary their experience within the Aerodynamics Department. Candidates with some years' experience preferred, but applications from juniors with sound mathematical ability will receive full consideration. In the first instance, please send full particulars of age, experience and salary required, to The Chief Designer, Gloster Aircraft Co., Ltd., Hucclecote, Glos. [0913

BRITISH EUROPEAN AIRWAYS invite applicants for indentured craft apprenticeships in the trades of radio mechanics, instrument mechanics, and aircraft electricians. Applicants must be of British nationality, must be 16 years of age on September 1, 1951, and should have attended a secondary grammar or secondary technical school. They will be required to undergo a course of technical education in addition to an initial period of practical training at a Ministry of Supply establishment or manufacturer's works, with a further period at one of the Corporation's bases. There is no premium; apprentices will receive a wage and, whilst away from home, a maintenance allowance. Applicants must state details of technical training and any other relevant information, accompanied by a letter of consent from candidate's parents or guardian, and copies of school references.—Applications, to be addressed to Personnel Manager, B.E.A., Keyline House, Ruislip, Middlesex, must be received by August 17, 1951. [0750

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AIRLINE captain, 5,000 hours, 4,300 hours in command A.L.T.P. and R/T licences, instrument rating, at present employed in Far East, desires change.—Judd, c/o Barclays Bank, Ltd., 61 Old Christchurch Road, Bournemouth. [0757

ENGINEER, licensed A. and C. all groups, with the addition of Douglas C54 airframe and Pratt and Whitney R-2000 series engines, seeks change of employment. Capable of organising and supervising either inspection or maintenance. Box 3302. [0753

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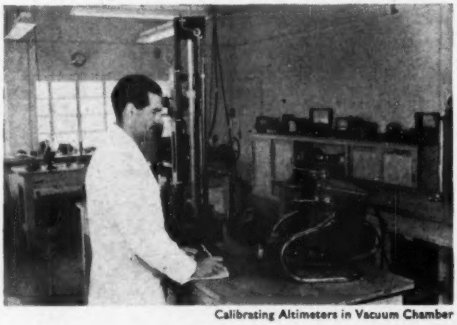
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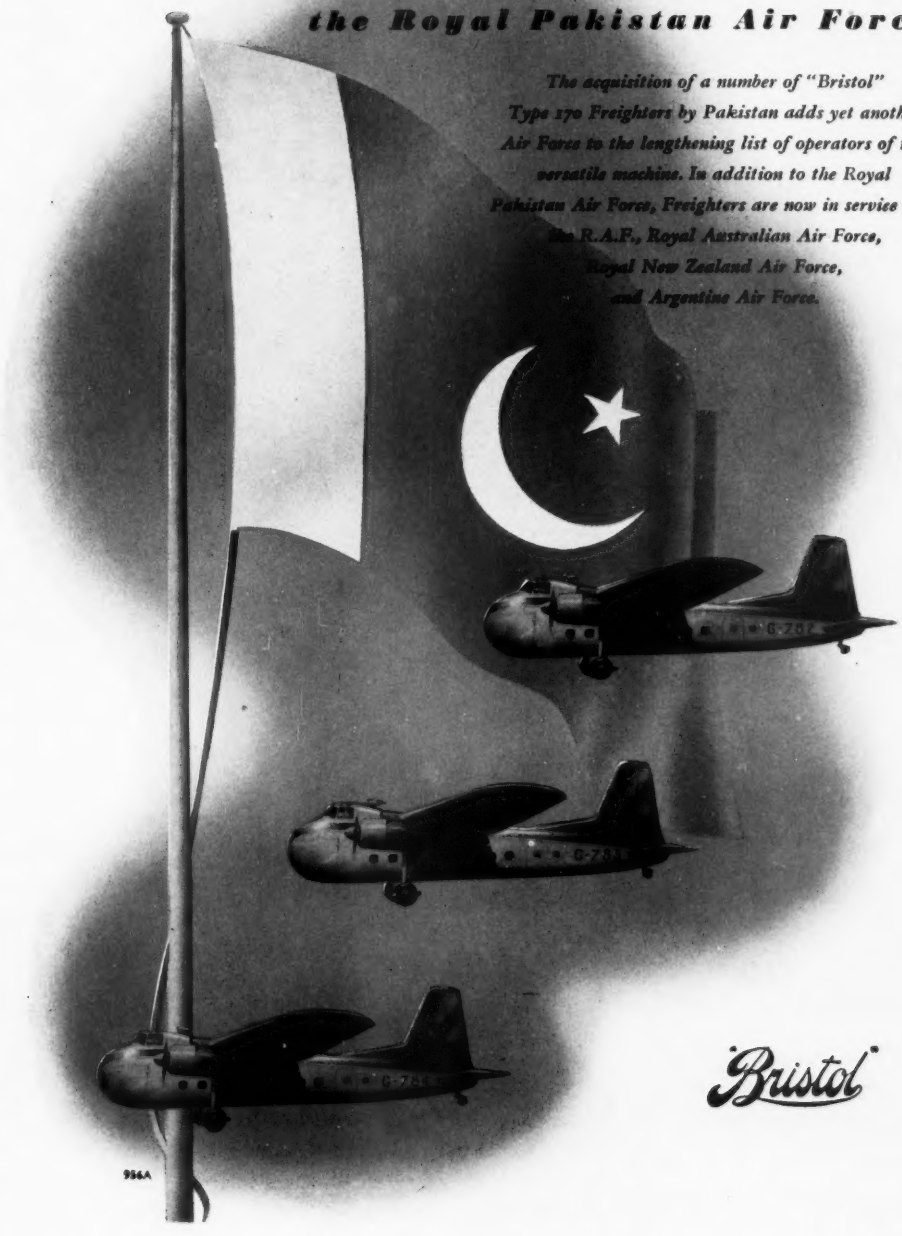

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